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RESTRICTED

PROJECT

120 mm MORTAR UB M 52

DESCRIPTION, OPERATION AND MAINTENANCE MANUAL

TEXT

SECOND EDITION

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Description, disassembling and assembling of the Mortar

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A - Placing of the Mortar in battle position

I. GENERAL CHARACTERISTICS

The 12o-mm Mortar serves for destruction of firing means and man-power of the enemy, especially those posted on rear slopes, in ravines and light shelters, as well as for destruction and demolition of light objects of field fortifications.

Due to the powerful effect of the shell, great firing rate and precision, its light weight and easy mobility, this Mortar can always render timely support to the infantry in all combat phases and conditions.

The trajectory steepness and small space the Mortar occupies when in firing postion permits its placing in deep shelters, (bomb craters) which cannot easely be observed and hit by enemy fire. Having these characteristics, the Mortar can engage all targets located on rear slopes and in deep shelters which cannot be engaged with weapons firing at low elevation angles.

There are 2 models of the Mortar 12o mm and that:

- 12o mm Mortar UB M-52, designed for mountain and field transport,

- 12o mm Mortar, UB M-52-I with built in suspension for motor towing (neither equipped with accessories for loading on pack animals, nor for tanden towing).

For transportation in the mountains the Mortar should be disassembled and loaded on five pack - animals. It is a most suitable weapon for transportation

and action in mountainous and rugged regions.

For the purpose of reducing the pressure of the base-plate on the ground, this Mortar is equipped with a hydraulic recoil brake and recuperator. This enables firing on all types of ground, rocky ground, concrete, macadam, asphalt and swampy ground, and under any of these conditions the weapon will keep its firmness. This feature makes it a most remarkable weapon for street operations.

The Mortar is not equipped with any special conveyance means more than its own wheels on which it is transported and fired from.

In changing to combat postion it is not always necessary to dig-in the base-plate; this enables to open fire directly after arrival on the fire position.

The Mortar 12o mm UB M-52 may be transported in tandem, tow, on five pack-animals and in emergencies also by motor towing but in the latter case the speed must not exceed 15 kilometers per hour. For quick transfer to distant places the Mortar should be loaded on motor trucks, dissassembled or assembled.

The mortar 12o mm UB M-52-I with suspension is towed by a prime mover, with a speed up to 45 Km/h on a good road. This model of mortar can be dissassembled into 5 main groups, too.

Because of rather light weight of individual parts of the Mortar when stripped, on difficult terrain and when short distances are in question the Mortar may be either towed or carried by its crew.

The Mortar fires fin stabilized light and heavy shells. The wight of the light shell is 12 kg and

the weight of the heavy shell is 15.9 kg.

Loading of the Mortar is done by dropping the shell in the barrel.

By changing the number of increments, from one to six, and the angle of elevation-from 45° to 80°-the following ranges may be attained:

- with a light Mortar shell from 265 to 6065 m
- with a heavy Mortar shell from 195 to 4760 m

On firing, the barrel recoils over the lenght of 200 mm because, with its base, it bears on the piston rod of the hydraulic recoil brake the function of which reduces the pressure on the base-plate, and on the ground respectively by over two thirds of the same calibre Mortars not equipped with hydro-elastic systems.

The Mortar is equipped with the sighting device "NSB-1" which serves for taking elements necessary for aiming and firing. The interval values of the sighting device are 1/6400 of the circle circumference.

Every Mortar is equipped with a set of spare parts, tools and accessories, and each battery of Mortars is equipped with a battery set of spares, tools and accessories.

Differences in design between the models

The mortar 120 mm UB M-52

Based on experience gained in service, various improvements have been carried out on some parts of the weapon. The effected improvements are of minor importance, thus not imposing an alteration of the existing model but those improvements can be carried through on all the mortars, when they come to regular repair.

On the Mortars of this model there are following differences:

1. On the first lots the screwed bushing and locking screw for rough cross-levelling of the bipod are turned upward (Fig.17a).

With the further lots the screwed bushing and the lock screw are turned by 180° for the purpose of easier handling.

2. The first lots have not a welded hydraulic recoil brake cylinder stop, on the flange of the ball shaped socket in the base-plate (Figs.24 and 24a).

3. On the newer lots of the mortars improvements have been carried out on the following parts of the firing mechanism:

- striker spring,
- support casing, (Fig.5a)
- striker (Fig.5b),
- firing pin (Fig.5c),
- front part of the two part casing (Fig.5d).

4. On the newer lots of the mortar the safety lock in the elevating mechanism crank hand grip has been built in, which prevents unscrewing of the shaft during transport.

5. On the newer lots of the weapon instead of leather jointings in the hydraulic recoil brake and recuperator, rubber jointings have been built in. On all the weapons the leather jointings have to be replaced by rubber jointings.

6. On the first lots of mortars the hydraulic recoil brakes have been filled with a glycerine liquid "Steol J" while the recuperator filled with air.

x) On the newer lots of the weapon the hydraulic recoil the recuperators with nitrogen.

The mortar 120 mm UB M-52-I

On this model the same improvements have been effected which have been mentioned above for the model UB M-52. Besides, compared with model UB M-52 there are following differences:

1. The wheels with semi-pneumatic tyres are equipped with suspension for motor towing, permitting a speed up to 45 Km/h on good roads (Fig.20a).

2. This model of mortar is not intended for tandem towing and therefore there is no attachment for the thill fork on the lunette (Fig.3a).

3. The disassembling into 5 main groups, provided with elements for pack loading, has been made possible, but the weapon set of spares is not completed with corresponding pack saddle accessories, the weapons being destined for motor towing only.

x) brakes are filled with glycerine liquid "Steol MM", while

II. THE MAIN PARTICULARS OF THE WEAPON

A) GENERAL DATA

Calibre	12o mm
Maximum range with light Mortar shell of 12 kg	6.065 metres
Maximum range with heavy Mortar shell M.49 of 15.9 kg	4.76o "
Minimum range with light Mortar shell of 12 kg	265 metres
Minimum range with heavy Mortar shell M.49 of 15.9 kg	195 metres
Maximum allowed individual pressure of propellant gases	1.o3o kg/cm^2
Mean pressure of propellant gases:	
- for light shell of 12 Kgs	1.ooo Kg/cm^2
- for heavy shell of 15.5 Kgs	95o Kg/cm^2
Weight of the weapon in combat position, approx.	387 kg
Weight of the weapon in marching position, approx.	4oo kg
Vertical field of action	from 45° to 85°
Horizontal field of action:	
without moving the wheels	3°
by moving the wheels-to right or left	45°
Firing rate	25 rounds/min
Track widhft 12o mm UB M-52	94o mm
12o mm UB M-52-I	1.155 mm

Pressure in recuperator	9 atm.
Liquid in recoil brake	3.650 lit
Recoil lenght - max	205 mm
- min	185 mm
Lowest point of the weapon (clearance)	300 mm
Wheel diameter	670 mm
Kind of tyre	solid-semielastic
Maximum towing speed (with spring)	45 km/h
Length of weapon ready for marching	2.250 mm
Pressure on the thill animal in tandem	19 kg
Number of animals in tandem	2
Number of packs for the weapon	5
Crew	5 men

B) WEIGHT OF WEAPON PARTS

Barrel with towing lunette	71 kg
Base-plate	73.5 kg
Recoil brake and recuperator	84 kg
Bipod	38 kg
Weight piece	38 kg
Wheels:	
- without suspension	81 kg
- with suspension for motor towing	100 kg
Sighting device	1.5 kg

C) WEIGHT OF ACCESSORIES

Thill fork	14.5 kg
Thills (2)	11.5 kg
Lanyard - long	1.1 kg
Weapon set, spares, tools and accessories	6.3 kg
Battery set, spares, tools and accessories	8 kg
Frames with tools	16 kg

Barrel fastening ring on the pack-saddle . .	3 kg
Hydro-elastic system fastener on pack-saddle	2.7 kg

D) WEIGHT OF PACK SADDLE

Weight of pack-saddle with accessories for one pack-animal	45 kg

E) TIME REQUIRED TO GET THE WEAPON READY

From tandem to combat position	1'4o"
From combat position to tandem	1'
From combat position on pack-animals . . .	3'
Assembling and loading on motor truck . .	2'3o"
Loading of assembled weapon on motor truck	3o"
From motor towing to combat position . . .	3o'

III. DESCRIPTION, DISASSEMBLING AND ASSEMBLING OF THE MORTAR

The principal parts of the Mortar

A - Barrel

B - Hydro-elastic system

C - Bipod

D - Base-plate

E - Wheels (with, or without suspension, depending on model)

F - Sighting device

A - THE BARREL

The barrel assembly consists of:

- barrel with breech ring
- triggering and firing mechanisms
- towing lunette

1. The barrel with breech ring (Fig.3-8)

The barrel and the breech ring are welded together and compose an integral unit.

The overall lenght of the barrel is 1.290 mm

The bore length of the barrel is 1.150 mm

The weight of the barrel is about 61 kg

The bore of the barrel is smooth.

Outside on the muzzle is a collar which serves for fastening of the lunette.

On the front part of the barrel is the quadrant level plate and a white line which serve for aiming

of the Mortar on the target.

In the middle part of the barrel is a cylindrical blackened swelling which slides through the collar of the hydro-elastic system during barrel recoil.

On the breech ring of the barrel is a semi-circular projection for fixing the position of the barrel when assembling with the hydro-elastic system.

The rear part of the breech ring diameter is reduced; its shape is rounded and it is adjusted for connecting to the seating on the piston rod of the hydraulic recoil brake. On the breech ring are two holes through which the "U" bolt is passed to fasten the barrel to the hydro-elastic system.

On the external upper end of the breech-ring is a projection provided with a seating for the trigger mechanism.

On the lower end of the breech-ring is a recess to receive the firing mechanism.

The external surface of the barrel is painted and the swelled part, the breech ring and the quadrant plate are blackened.

2. The trigger and firing mechanisms (Fig. 3-6)

The trigger and firing mechanism is a repeater type. It consists of a trigger mechanism assembly and firing mechanism assembly. To facilitate maintenance the firing mechanism parts are blackened.

a) The trigger mechanism is fitted on its seating in the breech-ring transversally on the barrel axle and consists of the following:

- trigger

- trigger pin
- trigger retracting spring
- sear
- sear spring
- casing and
- 2 pins.

b) The firing mechanism is fitted on its seating from the lower end through the center of the breech-ring and consists of the following:

- copper jointing
- two part casing
- firing pin
- firing pin spring
- striker spring
- striker
- support casing
- striker spring support unit
- firing mechanism casing

c) Firing rate regulator. The trigger mechanism is designed so as to enable single shot and rapid firing of the Mortar; it is also provided with a safety lock to retain the firing pin in locked position.

The position of the trigger shows whether the trigger is locked.

The trigger position is indexed by engraved letters as follows:

"B" indicates rapid fire

"J" indicates single shot fire

"U" indicates locked

To set the trigger in any of the above positions the mechanism is set for single shot fire, rapid fire or whether it

the trigger should be pulled out of its seating so far as to pull out the trigger stop from its seat. Then the trigger should be moved to the desired index so far that, when released, the trigger stop snaps into the appropriate seat.

When the trigger is set on "B" - rapid fire - then the firing pin point protrudes from the breech ring. When the trigger is in this position it should not be pulled to fire. With the trigger in this position, dropping the Mortar shell into the barrel will cause automatic firing.

When the trigger is set on "J" - single shot fire - the firing pin is released and may be freely moved longitudinally in its seating. In this position, the firing pin is withdrawn into the breech-ring and when the Mortar shell is dropped into the barrel, only by pulling the trigger the firing can be accomplished, i.e. the firing pin moves forward and strikes the primer cap and under the influence of its spring the firing pin retracts again into the breech-ring.

When the trigger is set on "U" - locked-then the firing pin is withdrawn into the breech-ring, the trigger is fixed and may not be moved nor firing accomplished.

When removing the barrel from the hydro-elastic system, the trigger position should be set on index "U" - locked - as to enable free passage of the barrel through the collar of the hydro-elastic system. The same rule applies for attaching of barrel to the hydro-elastic system.

d) Disassembling of the trigger and firing mechanisms

To strip the trigger and firing mechanisms, proceed as follows:

- drive out the pin from the trigger mechanism casing
- pull out the casing with the trigger mechanism assembly from the seating
- unscrew the firing mechanism casing from bottom of the breech-ring
- screw in the screw bolt from the tool set into the striker spring support nut and pull out the firing mechanism assembly
- remove the copper jointing.

To strip the trigger mechanism assembly proceed as follows:

- pull out the sear from its seating in the trigger shaft
- remove the sear spring
- drive out the connecting pin of the trigger and the trigger shaft
- remove the trigger from the shaft
- take out the trigger shaft from the casing
- take out the trigger retracting spring from the casing.

To strip the firing mechanism assembly, proceed as follows:

- turn the front portion of the two part casing for 90° to free the interrupted screw and to separate portions of the casing
- take out the firing pin spring from the front

portion of the casing

- take out the firing pin from the rear portion of the casing
- unscrew the support nut of the casing
- take out the striker spring
- take out the support casing
- take out the striker

e) Assembling of the trigger and firing mechanisms

To assemble the trigger and firing mechanisms reverse the above procedure in the following order:

First: - assemble the firing mechanism

- place the copper jointing on the front portion of the casing
- place the casing in its seating taking care that the casing jut enters into the proper channel
- screw in the firing mechanism casing and tighten well with the proper wrench from the accessories set

Second: - assemble the trigger mechanism

- place the mechanism into the breech-ring and be sure that holes on the casing and breech-ring coincide
- secure the trigger mechanism with the pin.

f) The function of the trigger and the firing mechanisms during rapid fire (fig.6).

For rapid fire the trigger should be set on index "B" - rapid fire, - as explained under c) above.

When turning the trigger towards the index "B" the trigger shaft, on which is a dent, also turns. During this movement the dent on the trigger shaft forces the striker in forward position and the striker in turn moves

the firing pin so that it protrudes from its seating in the breech-ring. The firing pin will retain this position until the position of the trigger is changed.

By dropping the Mortar shell into the barrel the primer cap strikes the firing pin and accomplishes firing.

g) The function of the trigger and the firing mechanism during single shot fire (fig.6)

For single shot fire the trigger should be set on the inde. "J" - single shot fire - as explained under c) above.

In this position the firing is accomplished by a pull on the lanyard attached to the trigger. The pull on the lanyard causes the trigger and its shaft, in which the sear is located, to turn. During this operation the trigger turns clockwise. During this move the sear dent forces the striker to the rear and the striker in turn moves the support plate which compresses the striker spring. At the point when the spring is sufficiently compressed the sear releases the striker which, under the influence of the striker spring, flies forward and strikes the firing pin. The pin compresses the firing pin spring and with its point strikes the primer cap of the ignition charge and thereby accomplishes the firing.

After the firing is accomplished the firing pin, under the influence of its spring, retracts into the breechring and in turn forces the striker in its rear position. By releasing the lanyard the trigger retracting spring returns the trigger with its shaft in such position so that the sear pushes back its spring, retracts into its seating, and goes over from the front of the stri-

ker. The sear catches again the striker to get the mechanism again ready for firing.

On every pull of the trigger this cycle will be repeated.

h) The position of the triggering and firing parts when the selector is set at locked position(fig.6)

To lock the trigger and firing mechanisms the trigger should be set on index "U" - locked - as explained under c) above.

In this position the trigger is fixed, the sear is retracted in its seating and it is impossible to cock the firing pin and accomplish firing.

Wherever the barrel is to be detached from the hydro-elastic system the trigger should be set on index "U".

3. The lunette assembly (Fig.7 and 8)

The lunette assembly consists of:

- two part hinged ring
- hand grip with ring tightening screw
- lunette for motor towing
- sockets for thills with bolt (this does not exist in the mortar 12o mm UB M-52-I)

The lunette is attached to the muzzle by means of the two part hinged ring, which is fastened with a screw. The towing lunette may be attached on the barrel in two different ways, depending on the method of transportation. For motor towing the lunette is fixed from the upper side as an extention of the muzzle and for tandem and during action the assembly is set so that the lunette for motor-towing is turned in the direction of

the breech-ring, toward the center of the barrel on the upper side.

In emergency cases when quick convertion for action, from motor-towing position is required and there is no time, for re-adjustment of the lunette assembly, the Mortar may be fired without it, but it should be mounted on the barrel as soon as the situation will allow it because the weight of the lunette assembly increases the recoiling mass of the Mortar and thereby reduces the pressure on the base-plate.

B - THE HYDRO-ELASTIC SYSTEM (Fig.9)

The Mortar is equipped with a hydro-elastic system, which makes an elastical connection between the barrel and the base-plate of the Mortar. This system consists of a hydro-pneumatic system and spring loaded shock absorbers. The hydro-pneumatic system is connected to the bipod over the spring loaded shock absorbers.

The hydro-pneumatic system absorbs a great portion of propellant gases pressure which, during firing, stresses on the barrel and thereby reduces the pressure on the base-plate and on the ground respectively. This system renders the essential characteristic by which this Mortar is differentiated from all classical Mortars having rigid systems.

This reduction of pressure on the ground enables the Mortar:

- to be very stable during firing
- to fire from any type of ground
- to open fire very quickly without special preparation of the ground for the base-plate.

The type of the hydro-elastic system is such that the recoil brake and recuperator compose a unit and function together. The recoil brake is hydraulic and the recuperator is filled with nitrogen (azote). The recoil brake liquid is segregated from the nitrogen in the cylinders by means of two floating pistons, one in each recuperator cylinder.

In the weight piece of the hydro-elastic system is the counterrecoil buffer which functions on the principle of condensing the air.

The hydro-elastic system assembly consists of:

- hydraulic recoil brake
- nitrogen recuperator with collar
- shock absorbers
- weight piece

1. The hydraulic recoil brake (Fig.1o,11 and 12)

The hydraulic recoil brake consists of:

- cylinder
- cylinder nut
- piston rod
- piston and
- liquid

a) The hydraulic recoil brake cylinder

The end of the brake cylinder terminates in shape of a ball which joins with its proper socket on the base-plate. On the ball are two flat surfaces which serve to achieve the joint connection with the base-plate. On the bottom of the cylinder is a threaded plug with a copper jointing through which the liquid is poured into the recoil brake. On the external side of the

cylinder is a lug with a rotating roller which serves to determine the position of the lanyard and proper function of the trigger mechanism.

On the cylinder are two projection with which the hydraulic recoil brake bears on the loading bar.

The upper part of the cylinder is widened to receive two recuperator cylinders. On the widened part of the cylinder, on each side, is a small hook for fixing the load on the pack-saddle.

The shape of the cylinder hollow is such as to enable flow of liquid alongside of the piston. In the cylinder are four longitudinal piston guiding grooves.

From the hollow of the recoil brake cylinder, openings lead through the nut which serve for passage of liquid into recuperator cylinders.

On the upper side the cylinder is closed with a jointing nut.

The capacity of the brake cylinder is 3.650 lit of "Steol MM" hydraulic brake liquid.

The first lots are filled with liquid "Steol J" which is to be replaced by "Steol MM" (see "Repair").

b) The brake cylinder nut

The nut closes the brake cylinder on the upper side through which the piston rod of the recoil brake passes. The nut assembly with the jointings consists of:

1. The nut body with rubber jointing and steel ring.

2. The jointing set consisting of:

- steel ring
- ring
- tallowed wick pressing rings (2)
- tallowed wick
- jointing set nut with felt wiper

The nut has two eliptic openings on each side for passage of hydraulic liquid from the recoil brake cylinder into the recuperator cylinders.

The top side of the nut has key grooves and marks, which should be set between the marks on the recoil brake cylinder when tightening the nut. When these marks are properly set, the openings on the nut and on the brake cylinder coincide and the brake liquid may freely flow from the recoil brake cylinder into recuperator cylinders during recoil. This should be borne in mind during assembling.

The position of the nut is such that, at the same time, it acts as a stop for the brake piston when in upper position.

Sealing is ensured because the diameter of the opening on the bottom side of the nut is somewhat bigger than the piston rod of the recoil brake and therefore the liquid flow from the recoil brake stresses on the leather jointing ring which in turn expands and performs the sealing.

c) The piston rod with the piston

The piston rod is hollow and its shape is cylindrical. On the upper side it is widened and forms the piston rod head. On the piston rod head are ears to guide the piston rod in recuperator cylinders during recoil. On the inside the ears are provided with pressed bronze

bushings to reduce friction and to protect the recuperator cylinders from excess wear and from freezing. Each bushing is secured with two screws. The middle, widest portion of the piston rod on the upper side forms the barrel breech-ring seating and it is bored for the passage of the "U" bolt to tighten it with the hydraulic system. The "U" bolt is arranged so that it may not be removed from the piston rod.

On each ear is a cylindrical projection on which the weight pice is fitted.

In the center of the barrel seat is a plug to close the hollow of the piston rod and on the upper side is a semicircular incision to indicate the position of the barrel during assembling.

On the bottom of the piston rod head are two sectional projections to act as support during firing when the hydraulic system contains no liquid or nitrogen. Under such circumstances the Mortar may continue firing but using of larger charges than the third on soft and on semi-soft grounds is not permitted. In such cases firing on hard ground is forbidden.

The center portion of the piston rod is chrom-plated and polished to ensure sealing of the recoil brake cylinder during recoil. The chrom-plating protects the piston rod against corrosion.

The piston is of mushroom shape with four juts to guide it in the recoil brake cylinder. The piston is screwed on the piston rod and secured with a screw.

The upper part of the piston is flat and when the hydraulic system contains normal quantity of liquid it bears on the sealing nut.

The maximum permitted stroke of the piston rod during recoil is 2o5 mm.

On each projection of the piston rod head is a hook for loading.

2. The recuperator and the collar (Fig.1o,11, 12,13)

The recuperator serves to hold the recoil system (barrel, piston rod and weight piece) in extreme upper position and to return this system in its upper position after recoil.

The recuperator is with two cylinders. Each recuperator cylinder has a floating piston, which keeps the nitrogen segregated from the liquid in the hydraulic recoil brake.

The nitrogen pressure in the recuperator is 9 ± 1 atm.

The pressure in both cylinders is always equal because the cylinders are interconnected by a channel through the collar. For this reason the collar is really an integral part of the recuperator.

The recuperator parts are:

- two cylinders
- two floating pistons
- cylinder extensions

a) The recuperator cylinders

There are two identical recuperator cylinders 68o mm long. On the bottom ends of the cylinders are holes for liquid flow and they are embedded into the recoil brake cylinders and welded. On upper ends the recuperator cylinders are threaded for screwing on the extensions

The external surface of the cylinders is ground and blackened and the internal surface is finely polished.

The cylinders should be well cared for to avoid any serious damages which would impair the proper function of the piston rod and floating pistons. In the event that one floating piston fails in its movement due to denting or any other defect, the proper function of the hydraulic system as a whole will not be seriously effected because the recuperator cylinders are interconnected. In such cases the floating piston of the undamaged cylinder will carry on the function of both pistons with an increased stroke.

b) The floating pistons

The floating pistons segregate the nitrogen in the recuperator from the recoil brake liquid. Their function is:

- to transmit the pressure in the recuperator cylinders on to the liquid of the hydraulic recoil brake and to retain the recoiling system in upper position.
- to provide space for the liquid, due to liquid pressure, by condensing the nitrogen into the recuperator cylinders during recoiling
- to force back the liquid into the brake cylinder after completion of the recoil and to return the recoiling system in home position.

Each floating piston consists of:

- piston body
- two rubber rings
- support intermediate ring
- steel ring
- nut with lock.

The body of the piston is made of steel and it is hollow; its bottom is tapped for screwing in the rod to facilitate extracting of the piston from the cylinder.

On the bottom the piston is extended to release it and, when in lowest position, to avoid closing of liquid flow holes from recoil brake cylinder to recuperator cylinders.

If the hydraulic recoil brake is properly filled the floating piston with its extension is at a distance of 7o mm from the bottom of the cylinder.

c) The recuperator cylinder extensions

On each recuperator cylinder an extension is screwed on, which seals the recuperator cylinder by means of a copper ring. On the extension the collar is being set on and on the upper side in the extension an air filling valve is buit-in. Besides, on the upper side the extension is threaded to receive the collar nut and the valve protecting cap. Under the collar tightening nut is a steel washer which prevents transmission of the nut friction on the rubber jointing and its destroying during tightening.

In the middle of the extension is a semi-circular channel with two holes. These holes serve for passage of nitrogen through the collar from one into the other cylinder and the semi-circular channel ensures this connection regardless of how far the extension is screwed. For assuring the nitrogentightness, on each side of the collar openings are two rubber jointings.

On the upper part of each extension an air filling valve is built-in, which is identical to

automobile tyre air valves.

The valve consists of:

- valve body
- valve needle and
- cover cap.

The valve assembly is soldered on the extension. The needle is screwed in the valve body and it is provided with a spring and a sealing rubber jacket. On top of the valve a protecting cap is screwed on which also serves as additional seal when the needle is defective.

Both valves are identical. On the one the reduction piece with hose is screwed on for filling from the pressed-air bottle, and the other serves for pressure control during filling (Fig.32a).

On top of the valve cap is a recess which serves as a key for tightening or releasing of the needle.

The cover cap protects the valve assembly from injuries and also serves as additional seal if the valve leaks nitrogen. To achieve this the cover cap is provided with a fiber jointing.

The collar tightening nut and the valve cover cap are secured with screws.

d) The collar (Fig.13)

The collar serves as:

- connection between the recuperator cylinder and for air passage
- barrel slide during recoil
- carrier of shock absorber cylinders.

On the inside the collar has five bronze slides secured with screws.

In the collar itself is a channel, which serve as nitrogen passage from one cylinder into the other. This channel enables filling of nitrogen into the recuperator through either valve.

The opening of the collar is designed so as to enable passage of the trigger during disassembling and assembling of the barrel. On the outside of the collar where the trigger passes a pintle is welded, on which the counter-recoil buffer piston rod is set, which is built-in the weight piece. There is a hole in this pintle for the joint securing pin.

On the face of the collar two shock absorber cylinders are welded.

3. The shock absorbers (Fig.13)

The shock absorbers make the elastical connection between the bipod and the hydraulic system. Their function is to reduce the propellant gas pressure on the bipod at the moment of firing.

There are two shock absorbers, each consists of:

- cylinder
- piston rod
- two part stop with bushing
- long spring
- short spring
- nuts.

The shock absorber cylinder serves to house all the parts of the shock absorber. The cylinder is welded on to the collar. On the bottom of the cylinder are two screw holes which hold the nut lock. On the inside the cylinder is polished and on both ends it is threaded to

receive the bronze bushing through which the shock absorber piston rod slides.

The piston rod serves as connection with the bipod. On the upper side is a projection with an opening for connection with the traversing mechanism device. On opposite side of this projection is a semi-circular stop which limits the movement of the piston rod.

Two springs are slipped on each piston rod, the upper spring which is longer, and the lower which is ~~longer~~, and the lower which is shorter. These springs are separated by a two-part ring stop fitted into the groove on the piston rod. Over this stop a bronze jacket is slipped on to prevent the ring from falling out; it serves also as piston ring guide. The piston rods are blackened.

The upper nut of the shock absorber cylinder serves as the spring seat, and the lower is the regulating nut and serves to adjust the spring tension.

The upper nut is secured with a screw and the lower with a sheet metal key which is being removed during adjustment of spring tension.

The long spring is slipped on the upper part of the piston rod and with its bottom end it sits on the stop ring jacket, and with its upper end on the upper bronze casing of the cylinder.

The short spring is slipped on the lower end of the piston rod and with its upper end bears on the bronze jacket of the stop ring, and with its lower end on the regulating nut.

4. <u>The weight piece</u> (Fig.14,15 and 16)

The weight piece serves to increase the recoiling mass in order to reduce the pressure on the ground

during firing, and during barrel recuperation it serves as counterrecoil buffer.

The weight piece assembly consists of:

- weight piece and
- counterrecoil buffer

The weight of the assembly is about 38 kg and it is provided with two shanks for fixing on cylindrical projections of the recoil brake piston rod where it is secured by a lynchpin.

Longitudinally the weight piece is bored to receive the counterrecoil buffer. On its sides the weight piece is provided with cylindrical projections for placement of securing springs during loading of weapons on pack-saddles.

On the upper side of the weight piece is a hole for sucking air during recoil. During firing the screw plug of this hole should be removed.

On each side of the weight piece is a hand grip for handling. On the left side of the weight piece is the index "B" - rapid fire.

On the bottom side the shappe of the weight piece is semi-circular for better fitting on the barrel. It is also provided with a cross groove to embrace the piston rod head.

The counterrecoil buffer serves to reduce the shock of the recoiling mass during barrel recuperation. It consists of:

- cylinder
- piston rod with piston
- bottom cover with regulator
- fastening nut.

The cylinder of the counterrecoil buffer is

set in the weight piece so that the air suction hole coincides with the hole on the weight piece. On the bottom side it is threaded for screwing on the cover and the regulator. Inside, it is polished to facilitate sliding of the piston. On the lower end the cylinder is threaded for screwing on the nut.

The counterrecoil buffer piston rod is joined to the collar and on the other end it is provided with a piston of aluminium bronze with a rubber jointing, which is fastened with a nut. The connection of the piston rod with the collar is secured by a pin.

The bottom cover with the regulator consists of a lid, rubber jointing and screw with a knurled head. The regulator serves to control the barrel recuperation speed.

The counterrecoil buffer cylinder is fastened in the weight piece with a nut. Into this nut an aluminum bronze bushing is pressed through which the piston rod slides.

5. The function of the hydro-elastic system during firing

a) Function of the Recoil Brake and Recuperator

1. During Recoil

During firing the pressure of propellant gases acts on the base of the barrel which bears on its seat on the hydraulic recoil brake piston rod. Owing to this the propellant gases stress also on the piston rod and drive it into the recoil brake cylinder. The piston being on the lower end of the piston rod, in its movement downward it applies pressure on the hydraulic liquid causing

it to flow between the piston and the trottling groove of the recoil brake cylinder. As the piston rod retracts into the cylinder during recoil, with its volume it forces the same volume of hydraulic liquid, through the holes on the recoil brake cylinder, into the recuperator cylinders. The hydraulic liquid entering the recuperator cylinder forces the floating pistons upward and these in turn condense the nitrogen from 9 atm to about 16 atm.

During recoil the barrel slides through the collar and the projections on the piston rod head slide over the recuperator cylindres and therefore all frictio ning surfaces should be clean and well lubricated during firing.

The recoil length with maximum charge ranges around 2o5 mm (min 185 mm). There is hardly any difference in recoil length when using various charges.

During recoil the counterrecoil buffer cylinder moves with the weight piece downward because it is connected to the recoil brake piston rod, and the piston rod of the counterrecoil buffer remains fixed because it is connected to the collar. On completion of its movement the counterrecoil buffer cylinder sucks air through the hole in the weight piece because at that moment the counterrecoil buffer piston has passed over the hole in the weight piece.

2. During barrel recuperation

When the recoil is completed, the compressed nitrogen stresses over the floating pistons on the hydraulic liquid forcing it back into the recoil brake cylinder and the liquid in turn forces the piston and the piston rod upward. The movement of the piston rod

is transmitted on the movement of the barrel and returns it in its home position.

During barrel recuperation the weight piece moves upward and the counterrecoil buffer piston keeps compressing the air into the cylinder until the barrel returns in its upper position. The compressed air leaves the cylinder through the hole in the regulator.

In case the barrel recuperation is slow or incomplete, the regulator x) should be gradually loosened until normal recuperation of the barrel, if the weapon knocks, the regulator should completely shut. In this case the compressed air remains in the cylinder and thereby reduces knocking during recuperation.

b) The Function of Shock Absorbers

Because of the propellant gases pressure on the barrel base after firing, through the medium of the hydraulic recoil brake, the pressure is transmited on the base-plate also.

Depending on the charge, ground quality and seting of the base-plate, it comes to backward movement nd sinking of the base-plate. The movement of the whole hydro-elastic system with shock absorber cylinders is conditioned by the movement of the base-plate. Due to inertion, the bipod with the traversing mechanism remains in place because they are elastically joined with the hydraulic system by means of springs. During this motion the long springs are compressed to the extent of the base-plate and hydro-elastic system movement and neutrilize the shock on the bipod.

After the propellant gas effect ceases, the

x) is obtained. During rapid recuperation

long springs expand in their original position and draw the bipod. Due to elasticity of the ground, the base-plate and the hydroelastic system now move forward and compress the short spring of the shock absorber cylinder. The short springs by expanding into their original position, via the piston rod, return the bipod in its initial position.

When the base-plate is fully seated on the ground, even on soft ground, the sinking of the base-plate is very slight due to the function of the hydraulic recoil brake which reduces the pressure on the ground for about two thirds in respect to Mortars of same calibre equipped with rigid systems. In such cases the stroke of shock absorbers is minimum.

If firing is carried out from soft grounds, when seating the base-plate, care should be taken to sink it to two thirds of its ribs as prescribed. Otherwise great sinking of the base-plate when the first shell is fired, will compress the shock absorber springs as to cause their coils to jump over one another. This may cause bending of shock absorber piston rod, screw spindle, wheel brakes, etc.

C - THE BIPOD (Fig.17)

The bipod serves as support of the Mortar barrel in firing position and for traversing and elevating of the barrel.

The bipod is, at the same time, also the limber of the Mortar because the wheels are attached to it.

The bipod consists of:

- triangular frame

- elevating mechanism
- traversing mechanism
- rough cross leveling mechanism
- sighting device bracket.

1. The triangular frame

The frame is the basic portion of the bipod. It joins all parts into one unit and forms the connection of the biped with the wheels. It is made of interwelded tubing.

On the upper side it is provided with a bearing on which the elevating mechanism is fixed. This bearing is fitted with a two piece bronze bushing. On the frame base slides is the rough cross leveling mechanism whose movement is limited by two ring shaped juts and it may not be removed. The centered position of the mechanism is marked with two lines.

On each side of the frame two split casings are welded on which form the wheel clamps. The clamp are provided with a recess in which the projections on the wheel bracket enter to mark their exact position. Fastenin of the carrier in the clamp is done by means of a clamp bolt. Traverse of the clamp bolt in unscrewing is limited and may not be removed from the clamp.

The frame is provided with two lugs for loading on pack-saddle.

2. The elevating mechanism

The elevation mechanism assembly is a vertical screw type. It serves for giving barrel elevations from 45^{o} - 80^{o}. It consists of:

- body

- elevating screw
- ball bearing
- distancing washer
- traversing nut
- bevel gear
- elevating crank.

The body of the elevating mechanism is cylindrical. On the bottom portion it is provided with a welded seating for the cross leveling mechanism. On the upper portion of the body is a casing for the ball bearing traversing nut, bevel gear whose shaft is provided with a crank. The teeth of the bevel gear are interlocked with the teeth of the traversing nut.

On top of the gear casing a cover is screwed on to prevent axial movement of the traversing nut.

On the casing is a roller projection for joining the mechanism with the bipod frame.

The elevating mechanism is fastened to the frame with one bolt which is secured with a safety screw.

On the upper end of the screw spindle the nut of the traversing mechanism is screwed on and secured by a pin.

On the lower side of the casing a seating is welded into which the cylindrical lock of the elevating mechanism handle is inserted, thus preventing the spindle from removing during transport.

From loosening, the gear casing cover is secured with a screw.

THE CRANK (Fig. 22)

The crank is a folding type. It consists of: body, hand grip, internal bushing, shaft, spring, washer and two pins.

On the body there is built in a cylindrical lock with spring, preventing the turning of the crank during transport when crank is in folded position.

To fold the crank, the hand grip should be pulled until the bushing projection leaves its seating and then turned 90° so that the projection enters the proper seat.

When folding the crank, care is to be taken that the cylindrical lock on the crank should get into the seating on the casing of the elevating mechanism.

3. The traversing mechanism

It is a screw type mechanism. Serves to move the barrel horizontally 3° on either side from the centered position. It consists of:

- traversing mechanism support with
- traversing screw nuts
- traversing nut with adjusting screws
- crank.

The mechanism support is scooped out and on its ends are openings for passage of the traversing screw. It is provided with two projections with bolts for connection of shock absorber piston rods. The connection is secured by passing the bolts through piston rods and

turning them for 90° so that locking ball enters its seating. To pull out the bolts they should be first turned toward the barrel for 90° and then extracted. During longitudinal movement, the bolt is secured from falling out by a safety screw.

The traversing mechanism support on its left side is provided with a projection for the sighting device bracket. Under the projection is a slot to receive the precise cross leveling mechanism. In the center of the support an index is stamped marking the centered position of the mechanism. This index should coincide with the index mark on the traversing nut when assembling the Mortar for march.

The support is provided with two hooks for fastening on the pack-saddle.

The traversing screw serves for moving the barrel in assembly with the traversing nut.

The traversing screw in the support, on the left it is limited by a ring and on the right side by two lock nuts. On the left side of the traversing screw the crank of the traversing mechanism is fixed and secured with a pin.

The crank (fig.22) is similar to the crank of the elevating mechanism, only that thereon the cylindrical lock with spring is not built in.

The traversing nut serves to move the barrel by means of the traversing screw. The traversing nut is screwed on from the bottom on the elevating mechanism screw and it is fastened with a pin.

In the upper portion of the traversing nut, on each side are nuts which serve to remedy the idling. In

order to prevent unscrewing they are fastened with lock nuts.

4. The rough cross leveling mechanism

The mechanism serves for rough cross leveling by getting the traversing mechanism support and with it also the sighting devices into nearly horizontal position.

This mechanism is really a clamp which may be moved on the bipod frame base. The movements of the clamp are transmitted on the traversing mechanism support over the elevating mechanism body.

In order to enable free movement of the mechanism the clamp is coupled to the body on principle of a swallow tail by means of a slide. When the mechanism has been brought into the position desired, it should be fixed by tightening the crank. The centered position of the mechanism is marked on the frame base an that is the position in which the mechanism must be set when being prepared for march.

5. The sighting device carrying bracket

(Fig. 23)

This bracket serves to fasten the sighting device NSB-1 on the bipod. It is attached on the lefthand side of the traversing mechanism support. The bracket consists of: body, bevel head shaft, bevel head shaft lifting spring, retracting spring and crank handle.

The bracket body is fastened to the traversing mechanism support through the precise cross leveling plate which is connected with the support by means of one screw.

In the body is the bevel head shaft and lifting spring. On the body is a transversal opening to receive the sighting device shaft. On the upper part of the body on the outside is the retracting spring which is fastened with its one end to the body and with the other to the support of the traversing mechanism. This spring serves to push the precise cross leveling mechanism adjusting screw toward the sighting device carrier bracket.

On the bottom side of the body are cam guide grooves whose function is to move the bevel head shaft when releasing the sighting device shaft. This movement is achieved by means of a bolt cam, fixed on the bevel head shaft, sliding in these guide grooves.

By turning the crank, the bevel head shaft moves down and releases the sighting device shaft which may be then removed. At this moment the pin enters the semi-circular recess on the body to fix this position.

The tension of the lifting spring holds the bevel head shaft in upper position and thereby secures the sighting device shaft.

Precise cross leveling mechanism (fig.23)

Its function is precise vertical adjustment of the sighting device to offset the influence of the bipod slope by adjusting the cross level to bubble.

It consists of:

- plate with fastening screw
- cross level set screw

On the plate and on the sighting device carrying bracket is a line to mark the centered position of the sighting device during rectification.

The sighting device carrying bracket retracting spring pushes the bracket so that leveling screw is in constant touch with the traversing mechanism support.

D - THE BASE-PLATE (Fig.24 and 25)

The function of base-plate is to transmit the pressure, created by firing of the Mortar shell and reduced for two thirds by means of the hydraulic recoil brake, on to the ground. During/transportation of the Mortar the base-plate functions also as an axle.

The shape of the base-plate is rectangular 850 x 670 mm and it is made of steel plate. It is provided with a spherical socket to receive the recoil brake cylinder.

On the upper surface of the base-plate are tubular brackets with appropriate clamps for fixing the wheels during transportation. Four circular projections and four hooks serve for fixing it on the pack-saddle.

Behind the ball-shaped socket there is a handle lined with leather for handling. On the lots of mortars where there is a handle on the front side of the ball-shaped socket too (Fig.25) the handle is to be removed from the base plate (Fig.24).

On the bottom side the base-plate is rib reenforced and on each corner is a spike for digging in. When the base-plate is layed on flat ground the spikes give it a slope of 15°.

The base-plate enables the Mortar a field of action of 45° to the left and to the right by moving the wheels.

E - THE WHEELS (Fig.26,27 and 28)

The function of the wheels is double, to carry the weapon during transport and to serve as bipod base during firing of the Mortar. They are made of light alloy and provided with solid semi-elastic tyres.

Differences in the wheel assembly depending on the models are:

- Wheels without suspension on model 120 mm UB M-52 (Fig.28)

- Wheels with suspension on model 120 mm UB M-52-I (Fig.28a)

1. The wheel without suspension assembly consists of:

- wheel
- wheel lock - in battle position
- two brackets with axle

The wheel. The wheel consists of: body with hub, roller bearings and hub cover.

The semi-pneumatic tyre is permenently pressed on the rim of the wheel. On the spokes are two rings for loading.

In the hub are two roller bearings.

On the outer side of the wheel the hub cover is screwed on, on which is a lug for hooking on the towing rope. The lug is fastened on the cover with screw bolt. On the lefthand wheel the hub cover is provided with an anticlockwise screw thread to prevent unwinding. On the inner side of the hub rim are recesses to receive brake bolts to block the wheel in order to prevent its turning during fire. On the same side a ring is screwed

in the hub to close it on the inner side.

When disassembling and assembling of wheels again take care to place each wheel on its proper side - left and right side.

The wheel brackets with axle. There are two brackets of which one is pressed in on the axle and its function is to engage the wheel with the base-plate during march and the function of the other is to connect the wheel with the bipod. Each bracket is provided with a bolt projection which should enter into its proper recess, one on the bipod clamp and the other on the base-plate clamp. In the opening of the bipod bracket is a bronze bush and from the inner side the bracket support is attached. The bipod bracket is provided with a grease cup.

The brackets are secured on the axles with nuts so that the bipod joining bracket is rotary while the base-plate joining bracket rotates with the axle a unit.

The shape of the axle is adapted to suit the roller bearings, which bear on the axle projection on the inner side of the wheel on the outer side they are being tightened with a nut.

To protect the hub against contamination, a liner with a rim provided with a felt packing is pressed on the axle. The liner is an integral part of the axle and it is not detachable.

The function of the brake is to block the wheel during fire. It comprises: the body (welded to the bracket), bolt, spring, nut, handle and pin.

The brake bolt has two positions. To block the wheel prior to firing, the handle should be pulled to

displace the pin from its seat. Then the handle should be turned 90° and released taking care that the pin enters into the deeper recess and the point of the bolt into the slot on the hub rim. To make this adjustment it may be necessary to move the wheel. The compression of the spring steadies the bolt in the slot.

In march position, the bolt should not be in the hub rim slot and the pin should be in the shallow recess of the wheel lock body.

2. Wheel assembly with suspension (on model UB M-52-I) consists of:

- the wheel itself
- the suspension with the wheel blocking device

Wheel is the same as on the mortar model without suspension and the wheels are interchangeable. Removing and mounting the wheel is effected in the same manner as on mortar models without suspension (UB M-52).

Suspension with the blocking device (Fig.28a)

The suspension with its cylindrical spiral spring makes an elastic connection between the wheels and the base-plate bracket.

The suspension consists of:

- semiaxle bracket
- the suspension bracket with rubber buffer and wheel blocking device
- base-plate bracket
- bipod bracket with lock bolt
- indicator
- spring holder

- spring
- spring guide
- shackle links with axle bolts

Semiaxle bracket connects the wheel with semi-elastic tyre in the same way as indicated for model UB M-52. On the upper side it has a rectangular mortise for the passing of the wheel blockingkey. The semiaxle bracket is connected, in from of a parallelogram, by means of two shackles, with the suspension bracket and spring holder.

Suspension bracket is angle shaped and has on its vertical side an inserted axle. On his cylindrical part, which is in form of a shaft, it has a key for tight fixing with the base-plate bracket. Beside this, the bipod bracket is being mounted on the shaft. The suspension bracket shaft has on its end a thread for screwing-on the nut, by which the mortar base-plate bracket, bipod bracket and indicator are fixed on the axle.

The suspension bracket on its upper side, has a key-way in which the wheel blocking key is fixed for blocking the mortar in combat position, which serves at the same time for blocking the suspension too. On the lower side of the bracket there is a circular groove for spring seating, and in the center of this groove the rubber buffer is fixed by a screw.

Wheel blocking device consists of a key with a handle and a key-way. On the key-way there is a stop screw for the key. The key on its lower side has a built in spring lock for the key position. By axial moving of the key, by the handle, by hand or lever taken

from the weapon set, suspension blocking is carried out first and thereafter when the key entered the slot on the hub rim of the wheel, wheel blocking is at the same time effected, in order the wheel should not turn when in combat position. When blocking, it should be considered possible by turning the wheel, that the key could enter into either of the slots on the hub rim. The blocking of the wheel can be easily carried out, when the barrel is in horizontal position. Two men of the crew, if necessary, should lean one against the barrel and the other pressing on the suspension spring. During blocking of the wheels it is necessary to turn downward by 180° the lock bolt winglet placed on the bipod bracket. By this it is made impossible to turn the suspension bracket round its shaft together with the wheel, because by the turning of the winglet the lock bolt of the bipod bracket comes in the semicircular notch on the suspension bracket shaft. The turning of the lock bolt is possible only when the position of the suspension bracket has first been so adjusted that the indicator, installed on the suspension bracket axle, matches the white line on the inner side of the bipod bracket.

When the lock bolt winglet is turned downward, then the wedge bolt enters into the notch, on the suspension bracket shaft, and prevents the turning of the shaft, respectively the forward moving of the wheel. By turning the lock bolt winglet upwards by 180° the suspension bracket axle is being released since the semicircular notch on the bolt allows now the turning of the bipod bracket on the suspension bracket shaft. This action is undertaken at proceeding from combat position to travelling

position.

Base-plate brackets are destined for connection with the base-plate in travelling position and are tightly screwed on the suspension-bracket shafts. Besides, its turning is prevented by a key on the suspension bracket shafts. The base-plate brackets on their cylindrical parts, which enter into the clamps on the base-plate, have lugs which must enter into the corresponding notches on the clamps. By this the regular travelling position of the wheels is obtained.

Bipod brackets are destined for connection with the bipod frame and are set on the suspension bracket shaft. To render possible their turning, gun metal bearings, provided with lubricators, are built in on this place.

On the bipod bracket a lock bolt is built in by which, when necessary, at placing the mortar in combat position, the turning of the suspension bracket round its shaft is being prevented and by this rendered impossible the moving of the wheels from their fixed position.

The lock bolt has a winglet-shaped handle and a lug which serves as a stop for the end position of the bolt. The bolt itself is semicircularly cut, so enabling the bipod bracket to turn on its bearing, depending on the position of the bolt in relation to the notch on the suspension bracket.

The lock bolt is fixed to the bipod bracket by a nut secured by a safety pin. Beneath the nut there is a spring-washer preventing the lock bolt from coming out of its position.

Indicator (Fig.28b) in form of a sheet metal ring with an arrow serving as index, is set on the end of the suspension bracket shaft so that it lies on the bipod bracket. In order that the indicator should not in its determined position in relation to the suspension bracket shaft, on the inner ring side there is a lug which enters into the groove on the suspension bracket shaft. The indicator which is fixed by a nut to the shaft rotates together with the suspension bracket shaft and when the arrow matches the white line on the inner side of the bipod bracket the turning of the lock bolt winglet, either into the upper or lower position, is rendered possible. When the arrow matches the white line on the bipod bracket, then the semicircular notch on the suspension bracket shaft is parallel with the wedged lock bolt.

Spring holder has the form of a plate with two parallel bearings and two shackle axle bolts. It serves as a jointing connection, on the lower side, with the semiaxle bracket and suspension bracket.

The bearing in the middle of the spring holder with its axle bolt makes a jointing connection with the spring guide and by this takes over the spring pressure. In the spring holder cemented steel bushings are pressed in, serving as axle bolt bearings.

The axle bolts connecting the spring holder with brackets are fixed with nuts and secured by cotter pins. To prevent turning the shackle axle bolts are fixed in the semiaxle bracket and suspension bracket by locking screws.

All the jointings are lubricated by pressed in lubricators in the spring holder.

Spring guide is by an axle bolt connected, as a jointing with the spring holder. The guide has a lug for the passage of the axle bolt and a rim for leaning against the spring. The spring guide can oscilate on its axle bolt. The guide axle bolt is fixed by a nut to the spring holder and prevents its turning in the guide bearing. The axle bolt is fixed by a locking screw.

The shackle links in form of a bracket with two bearings, connect the axle bolt journals on each side of the semiaxle bracket and axle bolt journals on the suspencion bracket making with the spring holder, a parallelogram, which renders possible the vertical moving of the wheel with the semiaxle bracket.

The shackle links have pressed in cemented steel bushings serving as journal bearings. Each bearing has a lubricator. The shackle links are fixed to the axle bolts by nuts, secured with cotter pins.

Suspension functioning

During travelling of the mortar, when the wheel comes to an obstacle, it lifts. This is rendered possible by the parallelogram connection existing between the semiaxle bracket and suspension bracket.

Due to the lifting of the wheel, the spring holders connected by its axle bolt with the semiaxle bracket, respectively the wheel, strive to lift this end of the spring holder and at this occasion the spring being compressed, or viceversa, when the wheel gets into a hole, the spring is being released. At this motion there results no lateral flexion of the spring, due to

the spring leaning on the spring guide which is connected by a jointing with the suspension bracket. The jointing connection between the spring guide and the spring holder renders always possible retaining on approximately vertical position to the guide.

In this way an elastic connection between the wheels and the other weapon components with the base-plate of the mortar is brought about. By this the harmful effects of the uneven roads during mortar towing, on sensible weapon elements, is prevented. Inasmuch as, owing to the excessive speed and very uneven roads, comes to a greater spring compressing, it will result in spring guide striking on the rubber buffer. As soon as such strikes have been felt, the speed must be reduced.

The allowed speed on good roads should be, at motor towing up to 45 km/h, while on bad roads the speed should be reduced depending on the quality of the road.

F - THE SIGHTING DEVICE (Fig.29, 30 and 31)

The Mortar is equipped with the folloving sighting devices:

- sighting device NSB-1
- quadrant M-1

a) The sighting device NSB-1

The function of the sighting device is to take direction and elevation elements and to point the Mortar on the target.

It consists of: sighting device body and head.

On the sighting device body are:

- elevating scale with index
- elevating micrometer with index

- collimator support worm screw on which the azimuth scale and collimator latch, longitudinal and cross levels and sighting device shaft are located.

On the sighting device head are:

- collimator
- azimuth scale.

The function of the collimator is sighting.It consists of a small metal tube in which there is a vertically slit small plate and lens.

The function of the lens is to enlarge the sheaf of the entering rays for better illumination of the vertical slit. The front and the rear of the collimator are closed with protecting glass. On upper side of the collimator is the open sight.

Vertically the collimator may be moved by hand and horizontally by means of the worm screw.

The azimuth scale is on the collimator support Horizontally it is moved together with the collimator.

The scale is graduated in 64 intervals. The value of each interval is loo mils. Each even interval is marked with a number and odd intervals are marked with a line only. The intervals grow by clockwise movement

The function of the azimuth micrometer is to set intervals less than loo mils. It is on the worm screw of the collimator support and its scale is graduated into loo intervals, the value of each interval being 1 mil. Every tenth interval is marked with a number.

Elevating scale. It is graduated in lo intervals. The value of one interval is loo mils.

Elevating micrometer. It is located on the elevating screw and its function is to take intervals less

than loo mils. The micrometer scale is graduated in loo intervals, the value of each being 1 mil. Every tenth interval is marked with a number.

Cross level. Its function is to set the sighting device in horizontal position.

Longitudinal level. Its function is to transmit the elevation to the barrel of the weapon.

The basic position of the sighting device is:

- elevating scale lo, equalling 45° elevation
- elevating micrometer o
- azimuth scale 32
- azimuth micrometer o
- levels to bouble.

b) The quadrant M-1

The quadrant consists of:

- round scale plate graduated in degrees
- shaft with level support and tightening screw
- frame with base.

The scale plate is in form of a flat ring and it is fixed on the level support and shaft with three screws. One quarter of the plate is graduated from o-9o° where every tenth interval is marked with its number, every fifth interval with a longer line and one degree intervals with a short line. The reading accuracy is one degree and by interpolation it is possible to take roughly half to 1/4 degree.

The shaft is broadened to enable fixing of the scale plate and the tubular level on it.

The shape of the frame is round and on the bottom of it a ruler is fixed, which serves as quadrant base, with which it is placed on the barrel quadrant

plate. On the upper side of the frame is the indicator.

Taking of commanded intervals

To take intervals commanded, proceed as follows:

-loosen the fastening screw

-set commanded interval on the indicator

-tighten the fastening screw

-set the quadrant on quadrant plate so that the level i.e. the arrow on the ruler-base is pointing in the direction of the line of fire

-give the barrel elevation until the level bubbles.

Rectification of the quadrant

The accuracy of the level on the quadrant is checked by means of a proved control level. When the control level bubbles and if the quadrant level does not bubble, all three screws on the plate should be loosened and the plate moved with the intervals toward the indicator and all three screws carfully tightened again.

Keeping of the quadrant

The quadrant is being kept in a leather box having a special seating. To place the instrument in this box it must be set on 90^{o}.

c) Packing of the sighting device

The sighting device is being packed in a wooden box equipped with a carrying sling.

Prior to packing the sighting device should be set at: azimuth 32-oo, elevation 1o-oo.

The sighting device rectification screwdriver, 2 levels and a cleaning rag are also packed in this box.

G - DISASSEMBLING AND ASSEMBLING OF MORTARS

1. Filling liquid into the hydro-elastic recoil brake

Filling and refilling of the hydraulic recoil brake with liquid in service unit, under normal conditions, is not permitted. In exceptional cases, the approval for refilling, resp.filling, of the hydraulic recoil brake is given by the competent technical officer. The filling of the hydraulic recoil brake can be carried out by an artillery Chief mechanic, only.

To fill the hydro-elastic recoil brake with liquid, the recuperator must not contain nitrogen and the floating pistons position should be approximately 10 cm from the lower end of recuperator cylinders. The hydro-elastic recoil brake should be completely assembled.

To fill, proceed as follows:

- turn assembly so that recoil brake cylinder is with its ball head facing upward
- unscrew the liquid filling plug
- pour into recoil brake 3.650 litres of liquid "Steol MM" by means of a funnel sieve.

During this procedure it may arise that the total quantity of liquid cannot be taken up by the recoil brake or that after pouring in the liquid there still may be empty space for more. In such cases, proceed as follows:

a) In case the recoil brake cannot receive the prescribed quantity of liquid, it means that the floating pistons are too close to the recuperator cylinder ends and in order to bring them in proper position,

proceed as follows:

- screw-in the liquid filling plug at the moment when the liquid has filled up the cylinder
- push piston rod upward to move the floating pistons, with the aid of brake liquid, and make room for the balance of liquid
- pull piston rod back to its position
- unscrew liquid filling plug again
- pour-in balance of liquid.

b) If it occurs that after pouring-in of full prescribed quantity of liquid into the recoil brake, there still is space for more, it means that floating pistons are too far from cylinder ends and to avoid having air in the recoil brake cylinder, proceed as follows

- push recoil brake piston rod slowly into the cylinder until the level of the liquid is flush with the plug opening
- screw-in the plug and tighten well

Note: If the liquid does not rise up to the plug opening after pushing the piston rod, the floating pistons are too far from cylinder ends and should be brought to about 10 cm from the ends by pumping air.

After filling the hydraulic recoil brake with liquid, it is obligatory to carry out artificial recoils, as long as the piston rod flange has not sat on the recoil brake cylinder flange.

2. Draining of liquid from the recoil brake

Before draining the liquid from the recoil brake it is essential to release the air from the recuperator, by way of air valve.

Then unscrew the plug and dip the cylinder, and drain the fluid into a clean container.

3a Filling air into the recuperator

In normal conditions the filling of the recuperator with air is strictly prohibited. The filling of the recuperator with air is exceptionally allowed in war times, in case of nitrogen lack. As soon as it is possible, the recuperator should be filled with nitrogen, instead of air. Prior to that, the filling of the recuperator with air is to be carried out with the air from the pressed-air bottle. If there is no pressed-air bottle available the filling and refilling of the recuperator is to be made by means of the foot pump, which is in the battery set.

Before filling air into the recuperator make sure that the recoil brake is filled with prescribed quantity of liquid and that the liquid plug is tightened firmly and the collar assembled so that it seals well.

When pumping with the foot pump, the hydroelastic recoil system should be in horizontal position, as shown on Fig.32.

To fill the recuperator with air, proceed as follows:

- unscrew lock nut of protecting cap of both valves
- remove protecting cap from both valves
- remove valve cap
- check function of valve needles
- attach rubber tube of the foot pump on one recuperator valve and pump-in 9 $\pm$ 1 atm of air; check

pressure on the other valve by means of air gauge.

For filling up with air about 350 strokes of the pump are required.

Check to see if valve needles are leaking air, and then reverse above procedure to return all parts in their places.

Before putting on the valve cap, check once more the pressure with the pressure gauge and if the pressure is between 8 and 10 atm the filling is considered finished

- after putting on the valve cap, screw on the protecting cap on the recuperator valve adapters. Tighten the protecting cap by a wrench, from battery set, prior checking if the fibre seal is in proper condition

- tighten solidly the protecting caps and secure them by screwing on the lock screw, which is on them.

If needles are releasing the air pumped up to 9 ± 1 atm, the nuts should be tightened.

If needles are in such bad shape that it is impossible to pump into recuperator 8-10 atm of air, they should be removed, inspected and if necessary replaced.

The solidly tightened protecting cap will prevent the reduction of pressure in the recuperator in case when the recuperator valve needles are in improper condition. In case that the valve needles are not tightened enough, the reduction of the pressure under the specified limit in the recuperator will be prevented by quick screwing-on of the protecting cap.

3b Filling nitrogen into recuperator

The filling of the recuperator is carried out colely with nitrogen from bottles. Nitrogen is supplied in high-pressure bottles of 15o atm. The bottles for nitrogen may have a capacity of 1o dm^3 containing 15oo dm^3 nitrogen /14o x 1o45 mm/, or a capacity of 4o dm^3 containing 6ooo dm^3 nitrogen / 2oo x 168o mm/. For the purpose of easy identification, the valve cap on the bottle filled with nitrogen is painted in yellow color. Since similar bottles contain other gases too, as hydrogen, oxygen, carbon dioxide etc, the contents of the bottle should be checked, before use, in order to make sure that the bottle contains nitrogen.

The nitrogen bottle valves are provided, on their outlet part, with a femal thread in which a reducing piece from the battery set is screwed in. This reducing piece is provided with a thread for screwing on the armoured hose. Such a thread is present on both ends of the armoured hose for filling of the recoil cylinder of the mortar. The armoured hose is also a component of the battery set, while the reducing piece for connection with the bottle valve should normally be always screwed on the armoured hose (Fig.32a).

To make sure whether threads suit, the reducing piece and the adapter of the armoured hose ought to be screwed on by hand. This check should not be made by force.

Even in case that the threads on the bottle suit to the reducing piece for filling, from the battery set, it is not yet sure that there is really nitrogen in the bottle. An error might have occured at

filling. Errors in marking and filling of the bottles can provoke serious injuries of personnel and material damages.

To prove that there is nitrogen in the bottle proceed as follows:

-open the bottle valve suddenly and let the inner pressure throw out the dirt and moisture from the valve opening on the bottle. If the valve gets white or very cold, then the bottle contains carbon dioxide,

-at a distance of several centimeters from the v lve, hold with pliers, wire or by other means a lighted cigarette on the way of the gas flow. The cigarette is in no case to be held by hand. The valve is to be slightly openede and if, under influence of the gas, the cigarette gives intensive light, and thereafter gets in flame, that proves that there is oxygen in the bottle. If the gas gives a yellow flame with smoke it is acetylene,

-if the gas causes the cigarette firstly to give faint light and if longer exposed to the gas brings about the going out of the cigarette, then it is nitrogen

After proving that the bottle is properly filled with nitrogen, with at least 3o atm., screw on the bottle valve, the reducing piece and adapter of the armoured hose from the battery set. The use of other kind of hoses (except of a regular copper tube for filling other artillery weapons, and this also only by using the reducing piece with the safety valve)is forbidden

-if the hose is of inferior quality, it will break during filling of the recuperator, the more if the valve on the bottle has been opened quickly.

To fill the mortar recuperator with nitrogen it

is necessary:

- to screw off the protecting cap lock of both the valves
- to screw off the protecting caps from both the valves
- to screw off the valve caps
- to check the correctness of the valve needles
- to screw on the reducing piece with the safety valve from the battery set on one of the recuperator cylinder adapters and tighten it solidly
- hold by one hand the end of the armoured hose, and with the other hand slightly open the valve of the bottle to secure a slight flow of nitrogen from the bottle through the hose
- screw on the end of the armoured hose on the reducing piece with safety valve and tighten it
- after tightening the armoured hose, open valve on the bottle more to fill the recuperator. If the bottle valve is too much opened, the nitrogen will escape to the atmosphere through the safety valve on the reducing piece. As soon as it has been felt, that the nitrogen goes out from the safety valve on the reducing piece, the bottle valve should be slightly closed to prevent unnecessary escaping of nitrogen.

Note: The safety valve lets out the pressure over 4o atm so that breaking of the armoured hose can never occur, nor can the recuperator be filled with nitrogen in such an extent, that its cylinders should get damaged. In spite of this safety, the pressure from the bottle is to be let out slightly so as to prevent

damaging the recuperator valve needles.

- during the recuperator filling with nitrogen on the other recuperator valve install from time to time, a pressure gauge /Fig.32 b/ and measure the pressure. When the pressure gauge shows 9 ± 1 atm stop filling, i. e. close the valve on the bottle with nitrogen

- screw off the reducing piece from the recuperator cylinder adapter and check that on the recuperator valve needles there is no pressure leakage. As to tightening of valve needles the same notes apply as mentioned for filling of recuperator with air /see para 3/.

4. Disassembling and assembling of shock absorbers

This assembly is being disassembled only when necessary to replace shock absorber springs, or at thorough cleaning and replacement of lubricant.

To disassemble the shock absorber, proceed as follows:

- uncrew the safety screw from upper bronze bushing and with shear wrench unscrew the bronze bushing from the shock absorber cylinder

- pull out the piston rod with parts connected to it

- on the bottom side of cylinder remove two screws of the sheet metal safety catch

- remove the sheet metal safety catch

- unscrew the bottom bronze bushing

- pull out the shock absorber short spring

To disassemble the piston rod, proceed as follows:

- bear the piston head against a wooden object

- compress the spring by pressing the bronze bushing until the bushing frees the two piece stop .

- remove the two piece stop from the groove on the piston rod and

- release the spring slowly and remove the bronze bushing and spring from the piston rod.

Notes to be observed at assembling shock absorber

Before assembling the shock absorber, clean thoroughly all the parts and lubricate them with gun grease and thereafter assemble then in following order:

- install on the piston rod the upper bronze bushing, the big shock absorber spring and then the bronze bushing guide

- lean the piston rod head against a piece of wood and compress the big spring together with bronze bushing guide so much as will allow putting in of the two-piece ringstop in the piston rod groove

- after putting in the two-piece ringstop in the groove, decompress the big spring, so that the bronze bushing guide embraces completely the two-piece ringstop and prevents its coming out of the groove

- install the short spring on the bottom bronze bushing and secure it from the lower side of the shock absorber cylinder for half the thread

- insert the piston rod with the compressed big spring in the cylinder, so that the lower end of the piston rod enters into the hole of the lower bronze bushing

- push the upper bronze bushing downwards in

order to make possible catching by a spanner from the battery set

- screw on completely in its position the upper bronze bushing, and lock it by lock screw

- screw on completely the lower bronze bushing in the cylinder until a distance of 7o mm is obtained between the semicircular stop on the piston rod head and the upper bronze bushing

- install the sheet metal safety lock of the lower bronze bushing and tighten the fixing screw

- secure the fixing screws by pulling a wire through the holes in the screw head

- check the functioning of the shock absorber by pushing and drawing of the barrel at elevation of 45^{o}.

The distance between the semicircular stop and the upper bronze bushing must vary from.....to....

The diference between two measurements is not to exced 2o mm.

5. Replacement of bronze slides in the collar

If found that the play between the barrel and bronze slides is greater than 1,5 mm the slides should be replaced as follows:

- unscrew the securing screws and remove slides

- put in new slides, secure them and check sliding of barrel by means of artificial recoiling and perform the rectification.

6. Disassembling and assembling the weight piece

To disassemble the weight piece, proceed as

follows:

- remove two bolts from projection on the piston rod and place them in appropriate seating on the weight piece

- extract the safety bolt from the piston rod on the weight piece

- if the trigger is in position "B" change it to position "U"

- remove the weight piece

- from front end of the weight piece unscrew the counterrecoil cylinder nut with the wrench and extract the piston rod with piston through front end

- through the other end of the weight piece extract the cylinder

To disassemble the piston rod:

- remove the nut with a wrench

- remove the piston

- remove the jointing

- remove the washer

- remove the nut from the piston rod and unscrew the seating from the nut

- unscrew the lower nut with valve from the cylinder and unscrew the valve

- take out the rubber jointing.

From the weight piece body unscrew the suction screw.

To assemble the weight piece reverse the above procedure but make sure the hole on the cylinder, respectively the semicircular notch (existing on newer lots of weapon UB M-52 and on all mortar UB M-52-I), coincides with the suction hole on the weight piece.

7. Disassembling and assembling of the traversing mechanism

To disassemble this mechanism, proceed as follows:

- loosen two nuts on right side of the support which secures the traversing screw spindle
- unscrew the traversing screw and traversing crank from the traversing nut
- loosen lock nuts on both sides of the traversing nut
- unscrew idling prevention nuts from the traversing nut and from these remove the lock nuts
- drive out the pin from the traversing nut and unscrew the nut from the elevating screw
- to remove the bolts serving for connection with shock absorber piston rods, the stop screw should be loosened and the bolt pulled out
- to remove the sighting device bracket, drive out the pin and remove the crank handle from the bracket shaft, loosen the securing screw of the precise cross leveling plate and pull out the sighting device bracket and the retracting spring from the traversing mechanism support. Then remove the plate together with the adjusting screw.

To assemble the traversing mechanism reverse the above procedure.

8. Disassebling and assembling of the elevating mechanism

For complete stripping of the elevating mechanism it is necessary first to remove the traversing nut,

and than to:

- loosen the securing screw on the cover of the elevating mechanism housing and to unscrew the cover
- pull out the elevating screw together with elevating nut and to unscrew the nut from elevating screw
- drive out the elevating crank handle pin which connects the shaft with the bevel gear
- pull out the bevel gear with shaft through the housing
- from bottom of the housing to pull out the ball bearings and the spacing washer.

To strip the crank handle, proceed as follows:

- drive out the pin on crank joint
- separate the crank assembly from the body
- remove the hand grip
- if necessary, straighten out the shaft plate and remove the spring and the shaft.

Assembling of this mechanism is done by reversing the above procedure.

9. Adjustment of the traversing mechanism

Due to wear of the traversing mechanism, excessive axial displacement of the traversing screw in relation to the support or the traversing nut in relation to the traversing screw, may arise.

If displacement of the traversing screw in relation to the support exists, proceed as follows:

- loosen the lock nut
- tighten the nut until play disappears, at the same time turn the crank handle to ensure smoothness of traverse, and when the play has disappeared:

- tighten the lock nut and
- check again smoothness of traverse.

This adjustment should be done by using two wrenches simultaneously.

If displacement of the traversing nut is in relation to the traversing screw, proced as follows:

- on both sides of the traversing nut loosen lock nuts
- tighten gradually both adjusting nuts, at the same time turn the crank handle to check whether idling has disappeared
- when idling has disappeared tighten the lock nuts and run the traversing nut from one end to the other to check smoothness.

lo. Removing the wheels

To remove the wheel, proceed as follows:

- remove the safety screw from external side of the hub and remove the hub cap with a wrench
- remove the cotter pin from the axle nut
- remove the axle nut
- remove the washer and
- pull out the axle from the hub by tapping lightly.

To remove the lug from the body cover, proceed as follows:

- remove the safety spring from the cover nut
- unscrew the nut from the cover
- remove the lug

To disassemble the wheel lock(on model without suspension), proceed as follows:

- remove the cotter pin from bipod bracket nut
- unscrew the axle nut
- remove the bipod bracket from the axle
- drive out the pin from the wheel lock hand grip
- unscrew the hand grip
- drive out the second pin from the wheel lock bolt
- pull out the bolt from the wheel lock body together with the spring
- if necessary unscrew the nut from wheel lock body seat.

To assemble the wheel reverse above procedure and at this occasion take care of the following:

- at installing the roller bearing on the semiaxle it is allowed that the inner ring of the roller bearing in relation to the semiaxle diameter, has a play of o,o55 mm. On account of this, the inner roller bearing ring is movable on the semiaxle
- before installing, the bearings have to be lubricated thoroughly with bearing grease, so that the grease absolutely covers all rollers and inner surfaces. At installing the bearing on the hub, do not apply too great force, to prevent damaging the bearing seating ring
- replace the felt seal on the felt holder if worn out and obligatorily deep it in spindle oil. Do not overfill the hub with grease. Take care that the left wheel be put to the left side, and the right to the right one when looking in travelling direction
- after installing the journal and tightening

it with a nut, loosen slightly the nut and lock it with a cotter pin

- check the wheel on shaking and free rotation too.

The tyre - the tyre on the wheel becomes worn aout with time, so that the grooves for direction maintenance completely disappear. When the tyre diameter is reduced to 630 mm, the wheel must be replaced

- replacement of the wheel must be effected in the cases, too, when bigger fragments fall-off the tyre due to mechanical damage or ageing.

11. Disassembling of the suspension(Fig.28a)

The disassembling of the suspension is carried out only in case of breaking of suspension spring, as well as in case of installing a new rubber buffer on the suspension.

The disassembling can be carried out only by specified tools (Fig.28c) according to the following procedure (Fig.28d):

- remove the complete wheel with suspension from the mortar, but prior to that block the suspension by pushing the wheel blocking key into the rectangular mortice on the semiaxle bracket

- place wheel to an apt place for disassembling, either to stand vertically as shown on fig.28a or to lie horizontally on wooden beams

- install the pusher (4) of the suspension disassembling fixture, as shown on fig.28c and 28d, so that with its semicircular seating the pusher be solidly seated through the spring holder cut-out on the spring

guide

- install the disassembling fixture (fig.28e) so that the fixture sides embrace the whole suspension, and with its lower base beams against the blocking key-way on the suspension bracket

- install the bracket with nut (3) between the fixture sides so that with its paws on the ends, it em-braces the sides

- screw the bolt (2) in the bracket nut as long as its lower part en-ters into the round seating of the pusher (4)

- drive out the cotter pin and screw off the nut from the axle bolt attaching the spring holder with the suspension bracket (Fig.28a, No.1.81.)

- screw off the locking screw (Fig.28a,No 196)

- tighten the bolt (2) of the disassembling fixture a-s long as an easy pushing out of the axle bolt out of its bearing is achieved

- after pushing out of the axle bolt from the sus ension bracket bearing, gradually screw off the fixture bolt, as long as the spring completely stretches out, i.e. when it is without any stress

- as soon as the spring detached itself from its seat on the rim of the spring guide, remove the dis-assembling fixture (Fig.28c) from the suspension

- drive out the cotter pin and screw off the nut from the axle bolt attaching the spring guide with the spring holder, and drive out the axle bolt from the bearing, but prior to that the axle bolt locking screw must be screwed off

- swing the spring holder so as to render pos-sible removing of the spring guide and the spring out of

the suspension

- unscrew by a nut the locking screw out of the suspension bracket body and remove the rubber shock absorber, if worn out and replace it by a new one.

Note: When disassembling the suspension, check the dismantled axle bolts and bearings on proper condition. In case that the axle bolts and bearings are worn out to a greater extent or seized, the spring holder should also be disassembled.

Remove shackle links from the suspension and replace the damaged parts (see the book on repair).

Installing of the suspension spring is carried out as follows:

- install the spring guide into the cut out on the spring holder and connect it by means of axle bolt with the spring holder

- install the washer and screw on the nut on axle bolt and lock it with a cotter pin

- place the spring on the spring guide

- install the fixture for disassembling and assembling of the suspension (Fig.28c) as shown on Fig. 28d, with the understanding that first the pusher (4) is placed into the cut-out of the spring holder

- install the bracket with the nut (3) between the fixture sides so that with the paws on its ends, it embraces the sides

- screw on the bolt (2) in the bracket nut as long as the bolt with its lower part enters into the round seat on the pusher (4)

- by screwing on the bolt (2) compress the suspension spring until the rectangular mortise on the

semiaxle bracket and the key-way on suspension bracket match, and thereafter push the wheel blocking key to enter into the mortise

- by installing the axle bolt attach the spring holder with the suspension bracket. If the holes do not match, then by tightening or loosening the fixture bolt render possible an easy insertion of the axle bolt. At installing the axle bolt avoid applying force

- install the washer, screw on the nut on the axle bolt and lock it with cotter pin

- remove the suspension disassembling and assembling fixture

- mount the wheel with suspension on the weapon and place the weapon so that the barrel be in horizontal position

- by a lever from the battery set draw out the wheel blocking key until it comes out of the mortise, on the semiaxle bracket, releasing by this the suspension. If necessary two men of the crew should press, one on the barrel and other on the base-plate, with the purpose of easier deblocking of the suspension.

Removing of wheel blocking device

The disassembling of the wheel blocking device is to be carried out in case of unsmooth moving of the blocking key in its key-way.

For this purpose it is necessary:

- to screw off the stop screw from the key-way on the suspension bracket

- to draw out the key from its seat, and hold the hand below it until the lock pin with its spring falls

out from the lower key side.

After removing, clean the seating, check the key and other parts to make sure there are no burns, and then carry out assembling.

On occasion of assembling the wheel blocking mechanism observe the following:

- the spring lock pin should not fall out at inserting the blocking key into its key-way
- that the stop screw is screwed on its place so as to get properly into the groove on the key.

12. Artificial recoiling of the mortar

The hydraulic recoil brake and the recuperator have relatively large fine machined inner surfaces, subject to deteorioration if not in use. The most serious cause resulting in a slow deterioration of material, is the corrosion effect of seals which are dry or with an acidic layer on them.

When theweapon is for a longer time out of use the seals can under influence of liquids create acidic reactions on their surfaces which have a strong corrosive effect, particularly on places where seals come into touch with cylinders, or piston rods. This acidic reaction is capable of destructing even the chrome plating, on the recoil brake piston rod, though it is otherwise unsensitive against corrosion. By movements of the piston rod and of floating pistons, this acidity is being declined by laying on the seals a new layer of liquid. This moving is in fact that, what is called artificial recoil. By the artificial recoil, the seals and the recoiling parts come into touch with the liquid and thus the appearance of corrosion is declined, because the

liquid neutralises the acid on the sealed places.

The forces, necessary to effect the artificial recoil are the following:

- at the beginning of recoil a force of 3oo kg is necessary

- at the end of the recoil, after pressing in the hydraulic brake piston rod for 21o mm, a force of 5oo kg is necessary.

Artificial recoil should be performed monthly, as on weapons in use by service units, as on the weapon in storage. Beside this artificial recoil must be effected:

- after every filling or refilling of the hydraulic recoil brake with a liquid

- after every filling or refilling of nitrogen in the recuperator

- after every detailed disassembling of the counterrecoil buffer on the weight piece

- in order to check the pressure in the recuperator instead of measuring the pressure by pressure gauge.

The artificial recoil can be carried out by a special device or by man power. For the artificial recoil carried out by man-power a solid wooden beam is used, which is placed on the barrel muzzle when the mortar is in maximally elevated position. Simultaneously on each side of the beam of 1o x 1o x 25o cm, 4-5 men of the crew should hang themselves as long as the brake piston rod with its segmental lugs did not touch the upper surface of the recoil brake cylinder flange. The recoil must be performed at least three times.

IV. AMMUNITION

1. He Mortar shell M 49 (heavy)

He Mortar shell M 49 consists of: shell body, explosive charge, stabilizer, booster and igniter.

The body of the shell is made of forged steel. The front portion of the shell is of an ogival shape, which forms the shell head on which an adapter - booster liner support - is screwed, in which the fuze is being screwed.

The middle, roller shaped portion, on which there are five ring grooves, is called the centering portion, and the function of the grooves is to seal the propellant gases.

Toward the rear end the shell body is narrowing and terminates with the shell tail on which the stabilizer is screwed.

The function of the stabilizer is to ensure proper flight of the Mortar shell through the air. It consists of a roller shaped portion up to 1.5 calibre long, on which six pairs of fins are welded. From the bottom of the stabilizer the ignition charge is being placed. On the roller shaped portion of the stabilizer above the fins are orifices through the ignition charge flash passes.

The markings on the shell body are:

- calibre of weapon ---------- 12o mm
- type of Mortar shells:high explosive- HE-M 49

-type of explosive charge ---------- TNT

-year and lot of manufacture ---------- 55o3-5

- the factory mark ---------- KYU

The explosive charge is TNT.

Mortar shell M 49 data:

- weight of shell with fuze ---------- 15,9 kg
- type of fuze (superquick or delay action) "Brandt" 45 TU"
- explosive weight ---------- 3.1 kg
- weight of fuze ---------- o.43okg

2. HE Mortar shell M 56 (light)

Data:

- weight of shell with fuze ----------12.25okg
- type of fuze (superquick of delay action) "Brandt 45 TU"
- weight of ignition ---------- 34 gr
- weight of increment ---------- 77.5 gr
- maximum range ---------- 6o6o m
- minimum range ---------- 265 m
- weight of explosive charge --------- 2.5ookg
- the marking on the shell body are -- HE-M 56

3. The "Brandt 45 TU" fuze

The function of the "Brandt 45 TU" fuze is to provoke the explosion of the shell on striking the target or any other obstacle on its trajectory.

It consists of:

- body with cap
- striking mechanism
- safety mechanism
- regulator

- booster

The fuze body (8) is made of brass and its function is to house internal parts. On top the body is protected by a cap (1) made of lead mass which is coated with black paint and it is fixed. This cap serves to seal the internal parts of the fuze.

On upper portion the fuze is marked "B-45 TU"

The striking mechanism (13), retarding mechanism (29) and regulator (23) are in the fuze body and their function is to provoke initial ignition impulse, to safeguard from earlier detonation and to regulate the detonation time.

For regulating the detonation, on lower portion of the fuze body, under the screw thread of the fuze, is the regulator which is provided with a slot on the outside by which the fuze is being adjusted on "T" - superquick or "Y" - delayed action.

The booster is buit-in on the lower part of the fuze and its function is to transmit the initial impulse on the explosive charge of the Mortar shell.

Adjustments of the fuze should be done as follows:

- for superquick action, the fuze is being adjusted in the factory. In this state the regulator slot is turned in direction of the longer fuze axle, toward the letter "T"

- for delayed action, the fuze is being adjusted before screwing on the shell, so that the regulator slot is turned 90° in any direction toward the letter "Y"

Adjusting of the fuze may be done by means of screw driver or pen knife. Should the regulator not turn

easily, do not use force.

Winding of the fuze on the shell should be done very carefully, and before winding it is imperative to examine the inside of the shell booster to make sure there is no dirt or hard matter.

Normally the fuze is carried separated from the shell in special packing. When the fuze is screwed on the shell, the shell may be transported in its original packing but only on short distances. During such transportation hadnling should be most careful.

The main feature of this fuze is its absolute safeness in the barrel and during climbing it is being armed only on descending trajectory.

The position of the fuze parts after firing

After firing, under the influence of propellant gases, when the shell starts forward, due to inertia, the arming ring (9) stops for an instant, overcomes the spring (1o) creating thereby a free space, leaving the safety pellet (11) free to move aside due to its weight and to release the primer cap support (13). At the same time the starting of the shell, due to inertia, the needle (2) partly overcomes the striker spring (5)which, after inertia on the trajectory has ceased, returns the needle in its initial position.

The position of parts on the trajectory(fig.39)

On the climbing part of the trajectory (fig.39) the fuze is absolutely safe and arming of the fuze cannot take place.

On the trajectory when velocity of the shell begins to fall off, due to air resistance on the fuze

and shell body which owing to this tends to stop, and the primer cap support (13) due to it not being influenced by the air resistance because of inertia, and after the pellet (11) moved aside, moves freely forward and with its forward end bears on the primer cap support stop (6).The primer cap support stop spaces the primer cap support from the needle for about 2 mm. When the primer cap support (13) bears on the primer cap support stop (6) only then does the protecting pellet (11) fallre out, which prevents contact between the needle (2) and primer cap (14).

The position of parts when striking the target

At the instant of striking the target or an obstacle, the primer cap support (13) is bearing on the primer cap support stop (6), the needle (2) due to pressure overcomes the striking spring (5) and the primer cap support guide (7) does the same due to inertia, and the primer cap support (13) tends to continue movement. Movement of the needle (2) to the rear and movement of primer cap support guide (7) and primer cap support (13) forward brings about pricking of the primer cap (14) by the needle (2) and thereby causing ignition of the primer cap.

When the regulator (23) is adjusted for super-quick action "T", the flash of the primer cap passes through the conductor by shortest way because the regulator body in that position is provided with a hole similar to that of the conductor, and the flash passes through freely, ignites the detonating cap (26) and the detonating cap the booster charge (27) which provokes explosion of the shell.

When the regulator is set for delayed action "Y", then the regulator with its body (23) shuts the conductor and blocks the passage of the flame by shortest way, and from the primer cap (14) the flame passes over the retarder (29) and in this manner travel of the flash to the detonating cap is prolonged causing delayed explosion of the booster charge.

4. Propellant charge

The propellant charge consits of an ignition charge and six increments.

The ignition and increment propellant charges for each type of shells are different and there fore are not interchangeable.

a) The ignition charge

The ignition charge functions as propellant means and means for igniting increments. During burning of the ignition charge the flash passes thorugh orifices on the stabilizer tail and ignites the increments.

The ignition charge for M 49 shell is placed in a pressed paper case, similar to a shot gun cartridge only it is somewaht larger, and the ignition charge for M 56 shell is composed of two parts: ignition and primer.

To protect it against moisture the ignition charge case is coated with paraffin.

During firing, the charge is pressed into the stabilizer with the thumb, taking care that pressure is not applied on the primer. The charge is pushed until the rim of the case base bears on the seat edge in the stabilizer. In the ignition charge for M 56 shell the primer is screwed into the stabilizer.

With the ignition propellant charge alone firing is not being carried out.

b) Increments

The increments are placed in six separate oblong bags which are provided with strings on ends for the purpose of tying the propellant charge to the tail of the stabilizer.

The propellant charges are hermetically packed.

The propellant charges are tied round the stabilizer tail so that the knots are uniformly spaced, and not one on top of the other, as to enable uniform burning of powder. Maximum six propellant charges may be tied to the stabilizer tail of the shell.

The propellant charges should be well cared for during rainy weather and therefore should not be unpacked until required for use.

5. Marking of ammunition

The ammunition elements are being marked to facilitate identification for proper using and maintenance.

The markings on the shell indicate: calibre of weapon, model of shell, kind of filler, time of filling and Works, where filled.

The markings on the propellant charges indicate, type of charge, calibre, weight of igniter, weight and kind of propellant, date of last test, stability date and lot, etc.

The fuze is marked "B-45 TY", meaning the type is Brandt, model 1945 and that the action may be set on superquick or delayed. Besides, the Works initials, lot number and year of manufacture are marked on the fuze.

6. Packing of ammunition

The HE Mortar shells may be packed two in one case or one in a case.

In both cases ignition charges and increments and fuzes are separately packed and hermetically closed. On every box is a label indicating the contents of the box.

In the head of the shell a plug is screwed to protect the threads. Before firing this plug is removed and in its place the fuze is screwed on.

The pressed board boxes are protected with paraffin.

Labels identical to those on inner packings are attached on sides of the cases, with data concerning ignition charges and increments.

V. HANDLING OF THE MORTAR AND AMMUNITION

A - Placing the mortar in battle position

a) General notes for placing the mortar

During placement of the Mortar in battle position whenever the situation allows it, care should be given to lay down the weapon most properly as explained hereinafter. As to mortar, model 120 mm UB M-52-I with suspension, it is necessary to adhere to the notes mentioned in the following texture:If this is achieved, moving of weapon and sighting alignment will be avoided during firing of first shells. This applies explicitly for firing the weapon laid on soft ground.

Normally, the Mortar should be set in fire position so that the base-plate is laid sloped on the ground under an angle of 20°-30°. To achieve this, natural slopes should be utilized whenever possible.

The wheels should be locked and set on the ground somewhat lower than the spherical socket of the base-plate

The distance between the wheels and the front edge of the base-plate, for elevations of 45°-60° should be 1150 mm, and for elevations of 60°-85° 700 mm.

During firing care should be taken that the elevating mechanism body and the barrel never surpass the angle of 85°.

In fire position, the clamps of the bipod and the clamp of the rough cross leveling mechanism should be well tightened.

The lunette should be tightened and faced toward the barrel breech ring so that the lunette ring is aligned with the white line on the barrel.

Generally, preparation of the Mortar for action requires some time and work about laying down the base-plate and care should be taken to carry out this work most properly.

To ensure that during firing the wheels will not move forward in spite of being locked, placing of blocks or similar in front of wheels is recommended.

As to mortar, 12o mm UB M-52-I if the wheel blocking device is out of order and the war circumstances demand it, firing can be made without suspension and wheel blocking. In such a case some means, found on the spot (stone, wooden block etc) is to be put before the wheels, which will certainly prevent sliding of the wheels forward. If there are no means to be found for wedging, the wheels should be slightly dug in, taking care that on their rear sides they are free, i.e. on the side of the mortar base-plate, and that they have the possibility of moving freely in the direction of the base-plate.

It is strictly forbidden to place anything behind the wheels, because if the base-plate should not be properly set and slides back or sinks when the shell is fired, and owing to full compression of shock absorbers drawing back of wheels will not be able to take place. This may cause bending shock absorber piston rod, traversing mechanism screw or elevating mechanism screw.

After placing the Mortar in position, all friction surfaces should be well cleaned and lubricated. In emergency cases removal only of grit and dirt will be

sufficient.

In the course of firing during movement of wheels care should be taken to see that the axis of the wheels is nearly parallel to the traversing mechanism support.

b) Preparation of ground for the mortar

Preparation procedure depends on available time and type of ground, which may be:

- soft (ploughland, filled ground, without shrub or wet lawn)
- semi-hard (dry lawn and clay)
- hard (frozen ground, macadam, stony ground and asphalt)

Soft ground. Normally on this type of ground the base-plate should be dug in so that it sits on the ground under an angle of 20^{o}-30^{o}. In this case the wheels should be somewhat lower than the spherical socket on the base-plate.

If firing is not to begin immediately with the sixth charge, the base-plate need not be fully dug in. It is then sufficient to dig in the base-plate up to two thirds (2/3) of its ribs.

If the ground for the base-plate is not at all prepared, then to begin fire the strongest charge that may be used is the fourth charge and after the base-plate has found its seat on the ground, also the maximum charge may be fired then. Because the base-plate is not dug in, after several shots it will take horizontal position (on flat ground) and in such cases firing below elevation of 50^{o} should not be permitted.

Semi-hard ground. If time for usual preparation

of ground for firing is not available, firing of the weapon may be carried out without digging in the base-plate if firing is not foreseen with elevations below 55° and charges stronger than the fourth charge.

Hard ground. On this type of ground laying the base-plate will depend on the degree of hardness, exterml form and slope of the ground.

If the form of the ground is such as to prevent sliding of the base-plate to the rear, firing may be carried out under all angles and with all charges without special limitations.

If the ground is flat and there is a possibility of sliding back of the base-plate, it is forbidden to fire below elevations of 55°.

In any case efforts should be made to place the base-plate so that it stands firmly supported on all four spikes. To achieve this it may be necessary sometimes to level off some ground so that middle of the base-plate does not touch the ground before the other four spikes.

c) Preparation of the mortar 12o mm UB M-52-I, from motor towing to firing position

- to prepare the mortar with suspension for firing from motor towing position it is necessary:

1. to disengage the towing lunette from the hock of the prime mover

2. to bring the weapon in firing position and take the main firing direction

3. while the weapon is in horizontal position, block the suspension and the wheels by a lever from weapon set. During wheel blocking, if necessary, one man of

the crew exerts pressure on the barrel, and another on the mortar base-plate, for the purpose of easier pushing the blocking key

4. turn the wheels together with suspension round the suspension bracket shaft so that the indicator arrow matches the white line on the inner side of the bipod bracket.

5. turn downward to the earth the lock bolt winglet on the bipod bracket and render impossible the ing of support bracket round its shaft

6. lay down the base-plate on prepared ground

7. remove the muzzle and the weapon covers

8. loosen the clamps on the base-plate and at the same time pull out both the wheels with bipod in forward position.

Note:-See under A/a, if the wheels are not blocked -

This operation is obligatorily to be performed by 3 men of the crew, with the understanding that 2 men pull out the wheels with bipod, and the third assists in holding the barrel on his shoulder

9. Attach the sighting devices

lo. place the mechanism handles in working position

11. check the functioning of the traversing and elevating mechanisms, and unlock the trigger mechanism.

d) Preparation of mortar from tandem to fire position

To prepare the Mortar for firing from tandem tow position, proceed as follows:

1. Pull out the bolt from lunette and remove

thill fork from seating.

2. Haul the Mortar in position and point the barrel in firing direction.

3. Lower the base-plate on the prepared ground

4. Remove the muzzle and weapon covers.

5. Loosen clamps on base-plate and at the same time pull out both wheels with the bipod in forward position and lock the wheels. This operation is carried out by three men, two men on the wheels and the third assists holding the barrel on his shoulder.

6. Attach the sighting devices.

7. Try the function of traversing and elevating mechanisms, and unlock the trigger mechanism.

8. Remove the counterrecoil buffer screw from the weight piece and screw it in the dummy screw hole. With newer lots of mortars UB M-52 this operation is not to be effected, because there are already two arifices for suction on the bolt.

9. Take to normal position.

e) Preparation of mortar from pack to firing position

Preparation of the Mortar for firing is carried out from single column of pack animals in numerical order of loads:

Base plate (No 1)

Wheels with accessories (No 2)

Bipod and weight piece (No 3)

Hydro-elastic system (No 4)

Barrel (No 5)

To achieve this, proceed as follow:

1. Remove the base-plate from pack-saddle and

place on the prepared ground.

2. Remove the hydro-elastic system and place it in spherical socket on base-plate.

3. Remove the bipod with weight piece and wheels.

4. Join the bipod with wheels by means of clamps on the bipod.

5. Join the bipod with hydro-elastic system by means of bolts on the traversing mechanism support.

6. Remove the barrel, transfer the lunette on the barrel muzzle, place the barrel in its seat on the piston rod and secure with "U" bolt. In emergency cases, the lunette must not be replaced on the barrel.

7. Set the weight piece in place and fasten so that the body embeds on piston rod projections and the counterrecoil buffer piston rod on the collar projection secured with a bolt. Remove the counterrecoil buffer screw on the weight piece and screw in the dummy screw-hole. With newer lots of mortars UB M-52 this operation is not to be effected because there are already two orifices for suction, on the bolt.

8. Attach the sighting devices and release the safety lock of the trigger mechanism.

9. Try function of the traversing and elevating mechanisms and take to normal position.

B - Training on the mortar

a) Crew posts

The Mortar squad comprises: a squad commander and five men. The titles of posts follow:

1. Gunner

2. Loader

3. Fuze setter

4. First ammunition passer

5. Second ammunition passer.

During firing the posts of the crew are as follows:

- Gunner (1) on left side of barrel by sighting devices

- Loader (2) on right side of barrel level with gunner and facing him

- Fuze setter (3) one step to right of the base-plate

- First amm passer (4) one step to right of fuze setter

- Second amm passer (5) one step to the right of first amm passer.

The fuze setter (3) and second amm passer (5) are facing one another.

The squad commander is on a spot from where he can observe best the work of the crew.

b) The duties of the crew

1. Work of amm passers (No 4 and 5)

The amm passers should be well acquainted with the amm elements and should know how to prepare it for firing.

The first amm passer (No 4) takes out the Mortar shell from the case, holding it with one hand by the nose and with other by the tail and lays it down on the oil cloth. After that he wipes the dust and grease off the Mortar shell, and the second amm passer (No 5) puts the basic charge in the fin stabilizer of the Mortar

shell. When firing with light shell, this operation falls out because the basic charge is alr-eady in the stabilizer in which the igniter, too, is screwed on.

The first amm passer (No 4) holds the prepared Mortar shell by the cylindrical portion with his left hand and by the tail with his right hand so that the nose of the shell is facing the fuze setter (No 3), as to enable him to adjust the fuze for action, and the stabilizer should face the second amm passer (No 5) so that he may insert into the stabilizer the increments commanded.

After adjustment of the fuze for action is completed and the increments are inserted, the fuze setter (No 3) takes over the Mortar shell from the first amm passer (No 4) and hands it to the loader (No 2) holding the Mortar shell with his left hand by the cylindrical portion and with his right hand by the tail so that the nose of the Mortar shell is facing the loader (No 2).

In the same manner both amm passers (No 4 and No 5) may hand Mortar shells to the loader (No 2).

2. Work of the fuze setter (No 3)

The fuze setter (No 3) carries out the following operations during firing:

- adjustment of the fuze for action
- screwing on the fuze on the Mortar shell
- moving of bipod with loader (No 2) and amm passer (No 4).

The fuze is being adjusted on command "Fuze Superquick" or "Fuze with Delay". On command "fuze superquick", no adjustment is necessary because the fuze is so set in the factory and in this condition it is transported Therefore the fuze setter only makes a check to see

whether the slot of the regulator is set on "T" - meaning superquick.

On command "fuze with delay" then the fuze setter (No 3) turns the slot of the regulator with a screw driver to "Y" - meaning delayed. Turning of the regulator may be in either direction for 90°.

After the fuze has been adjusted it is being screwed on the Mortar shell. For this operation, the first amm passer (No 4) lifts up the shell holding it with bis left hand by the cylindrical portion and with his right hand by the tail. The fuze setter (No 3) sets the fuze vertically in the seating and screws it with the thumb and pointing finger of his right hand until the screw thread of the fuze is fully screwed in the Mortar shell. If necessary the fuze key from the accessories set may be used for winding the fuze.

3. The work of loader (No 2)

The loader (No 2) carries out the following operations during firing:

- rough cross leveling of the weapon
- loading of the Mortar
- moves the bipod with the fuze setter (No 3) and the first amm passer (No 4)
- cleaning and lubricating of friction surfaces and mechanisms.

Rough cross leveling of the weapon is carried out so that with one hand the barrel is held and with the other the clamp of the mechanism is handled, because if the barrel is not being held during this operation it may move abruptly on one or on the other side.

The weapon is being loaded on command "Loud"in the following manner:

The loader (No 2) bends down toward the fuze setter (No 3) or first amm passer (No 4) to receive the Mortar shell taking it with his right hand by the cylinder portion and with his left hand by the tail, checks the condition of the fuze, number of increments and whether the ignition charge is in the fin stabilizer and gives a loud report "Charge...".

Holding the Mortar shell with his hands by the cylindrical portion, puts it carefully into the barrel, fin stabilizer first. When the cylindrical portion has reached the muzzle, the loader (No 2) drops the Mortar shell into the barrel.

The loading of the shell should be done without forcing it into the barrel, because in the contrary the aiming will be disturbed.

Moving of the bipod is done by three men, two on the wheels and one supports the barrel from the front with his shoulder. The loader (No 2) in the center, the fuze setter (No 3) on the left wheel and the first amm passer (No 4) on the right wheel.

4. The work of the gunner (No 1)

The gunner (No 1) carries out the following operations during firing:

- mounting and removing of sighting devices
- taking and changing of elements on the sighting devices
- aiming and marking
- firing

Mounting and removing of sighting device.

To mount the sighting device proceed as follows:

- take the sighting device out of the box and hold in left hand

- turn the sighting device carrying bracket handle (with right hand toward yourself to the left) and place the sighting device in its seat

- when the sighting device has entered its seat, turn the sighting device carrying bracket handle away from yourself to the right

- open the covers of longitudinal and cross levels of the sighting device.

To remove the sighting device reverse the above procedure. Prior to removing see that the device is in its basic position and levels protected with covers.

c) Aiming

1. Taking of elements on the azimuth scale

To take the deflection commanded, the gunner turns the collimator support (sighting device head) and the azimuth micrometer until the commanded intervals on the azimuth scale and micrometer coincided with their indicators.

Turning of the collimator support during taking smaller deflections (up to 3-00) is done by means of the azimuth micrometer and during taking larger deflections by means of disconnecting the latch.

2. Taking elevation elements

The elevation elements are commanded and marked with two figures separated with a dash, of which the

first figure refers to the scale and the second to the micrometer. As example "Elevation 8-2o".

The gunner takes the elevation elements by turning the elevation micrometer with his right hand until the commanded intervals on the elevation scale and micrometer coincide with their indicators.

Note: To avoid the influence of idling of the sighting device, the elevation micrometer should be turned always in the same direction when taking intervals and not once in one and then in the other direction.

3. Changing the azimuth elements

Changing or correcting of azimuth elements is done on command "Left...." or "Right..." in the following manner:

- on command "right" the azimuth elements are being increased and on command "left" reduced.

When the azimuth is being increased the optical axis retreats to the left; due to this, during re-aiming the axis of the barrel moves to the right for the correction commanded. When the azimuth is being reduced the opposite occurs.

On command "right" the micrometer is being turned from oneself and on command "left" it is turned toward oneself.

When the gunner (No 1) takes the correction he should report the reading on the azimuth as to enable the squad commander to make a check.

4. Bubbling of the cross level

Bringing the cross level to bbble is done by using the rough cross level mechanism and the fine cross level mechanism.

To aim at a point, rough cross leveling is done by the loader (No 2) moving the mechanism over the bipod base.

During aiming the gunner (No 1) moves the traversing mechanism crank with one hand and with other hand the precise cross leveling mechanism. By simultaneous movement of both mechanism brings the vertical reticle on the aiming point and throughout this adjustment the cross level should bubble.

5. Horizontal aiming

Horizontal aiming may be direct and indirect.

a) Direct straight line aiming is done directly on the target with the elementary position of the sighting device (32-oo). In this position the sighting line and the line of fire are mutually parallel and simultaneously are pointed on the target by coinciding the vertical slit on the collimator with the target by means of the barrel traversing mechanism.

During this aiming the azimuth should keep its elementtary position.

By direct aiming the gunner proceeds as follows:

- sets the azimuth on elementary interval 32-oo

- points the weapon approximately in direction of the target (rough aim), shows how much the bipod should be moved to bring the collimator vertical slit nearly on the target

- points the weapon exactly on the target by means of the traversing mechanism, at the same time moving the head up and down in order to [illegible]a

simulated extension of the collimator vertical slit

- bubbles the cross level and at the same time aims on the target.

During aiming the eye of the gunner should be at distance of 5-6 cm from the collimator.

b) Indirect horizontal aiming should be carried out by means of aiming point with angle deflection which conforms to the angle between the aiming point and the target and which is taken on the sighting device.

During indirect aiming the procedure is as follows:

- on command "azimuth..., aiming point..." gunner (No 1) takes the commanded elements on the azimuth scale of the sighting device

- sets the vertical slit of the collimator roughly on the aiming point by moving the bipod if necessary

- coincides the collimator vertical slit with the aiming point by means of the traversing mechanism, to what purpose he may move the collimator vertically against the position of the aiming point so as to bring the vertical slit into an extension of the aiming point, underneath

- bubbles the cross level and at the same time aims

- when aiming is completed, reports "ready".

During horizontal aiming the azimuth scale elements must not be distrubed, thus all this work must be done by means of the bipod and exactly, by means of the traversing mechanism.

During indirect aiming there are dead angles for selection of the aiming point:

6. Elevation aiming is carried out on command "range..." as follows:

- set commanded interval on elevating scale
- transmit the elevation angle on the weapon barrel by bubbling the longitudinal level by means of the barrel elevating mechanism. During this operation loader (No 2) handles the rough cross leveling mechanism and gunner (No 1) with the precise mechanism bubbles the cross level
- on completion of the operation the report "ready" is given.

Note: Horizontal and vertical aiming is done simultaneously.

7. Direction marking

Immediately on completion of the horizontal aiming, the gunner will mark the direction or a nearby point for which he is sure that it will remain visible throughout firing.

On command "mark on...", gunner (No 1) proceeds as follows:

- not moving the barrel and the sighted direction, turns the collimator in direction of the reserve aiming point until the collimator vertical slit coincides with the marked point
- reads the obtained elements to the squad commander and reports "marking...ready".

Following this the gunner takes original elements and aims on the aiming point until it becomes

invisible when he transfers to the reserve aiming point.

When marking, traversing and elevating mechanisms must not be used in order not to disturb the barrel from aiming position. Special care should be taken to make sure that the sighting device prior to marking, stands upright, i.e. that the cross level bubbles.

d) Locking the wheels (Fig.47)

In order to attain stability of the weapon during firing it is obligatory that the wheels are locked.

During locking of the wheel without suspension one of the crew stands on the external side of the wheel by the hub and with his right hand lifts the wheel lock so that it leaves its seating and turns it in either direction 90° and then lowers it so that the pin enters the thicker recess and the bolt in the recess on the wheel hub.

To unlock the wheels reverse the above procedure, but it is advisable to unburden the lock by having one of the crew lift the barrel a little.

Note: The manner of wheel blocking on mortar 120 mm UB M-52-I (with suspension) is described in the part: "Preparation of the mortar 120 mm UB M-52-I from motor towing to firing position".

e) Firing the weapon (Fig.48)

The weapon is fired by the gunner by means of trigger parts.

Normally firing is carried out with the short lanyard, which is passed through a lug on the recoil brake cylinder and attached to the trigger.

At firing the lanyard should be pulled slowly

as to avoid disturbing of aim.

Ford rapid fire the trigger mechanism should be set on index "B" and in this position firing is carried by dropping the Mortar shell into the barrel, fin first.

f) Unloading of the weapon

When the shell fails to fire, the loader (No 2) reports "misfire", after what the firing of the shell should be repeated. If the shell fails again, the crew waits at least one minute. After this time has elapsed the trigger should be set at index "U" - meaning locked. Follow up by removing the weight piece pulling out the "U" bolt to free the barrel from the hydro-elastic system, pulling out the barrel completely and bearing the barrel breech ring on the collar. Then lower the barrel slowly and wait with the hand on the muzzle for the shell and remove it from the barrel. On the muzzle the Mortar shell is received by the loader (No 2), and carefully handed over to the fuze setter (No 3) who inspects it to determine the cause of misfire.

If the shell should fail to move, the barrel should be shaken a little and tapped with a stick.

g) Firing without liquid in the hydraulic recoil brake (Fig.49)

When firing without liquid in the recoil brake is to be carried out, it is obligatory to release. The pressure from the recuperator, to let down the recoil brake piston rod in extreme low position so it sits on the recoil brake cylinder rim with its projections.

Instead of liquid, soap suds may be poured into the recoil brake in emergency cases.

C - INSPECTION AND PROVING OF MORTARS AND AMMUNITION

a) Inspection of the mortar prior to firing

Firing of the Mortar is forbidden prior to its inspection and adjustment.

Barrel. Remove the grease from barrel. This is necessary x) to prevent lodging of the Mortar shell in the barrel and thereby causing misfire of the Mortar shell. The presence of grease in the barrel has harmful influence also on burning of the propellant charge. At ignition a portion of propellant spills from the bags and if the barrel is greasy propellant grains stick to it and fail to burn properly. Owing to this, great under ranges and abnormal dispersions may occur during firing, and therefore it is essential to remove all grease from the barrel prior to firing.

The swelled portion of the barrel, which slides through the collar, should be well lubricated.

Check to make sure that the lunette is properly fixed and tightened on the muzzle. Without towing lunette on the barrel, firing can be carried out only exceptionally, because at firing with more increments the stability of the base-plate is reduced.

Make sure that the barrel is properly set on the base-plate and that it is secured to the hydro-elastic system.

The trigger parts should be properly assembled and smeared with a thin coat of lubricant.

See that the firing pin is in good working condition and that the trigger may easily be set in position

x) not reaching the firing pin due to grease in the barrel and

for rapid, single shot fire or locked.

Elevating mechanism. Check to see that the elevating screw spindle lifts and lowers the barrel seat uniformly and without sticking, when the crank is turned.

Traversing mechanism. Check to see that the seat of screw spindle uniformly moves in both directions, when the crank is turned.

Cross leveling mechanism. Check to see that the rough cross leveling mechanism properly slides on the bipod base and that the clamp is in proper order.

Check the functioning of the precise cross leveling mechanism.

Shock absorbers. Check to see that shock absorbers unifromly and elastically vibrate by applying pressure on the barrel.

Hydro-elastic system. Check to prove whether the pressure in the recuperator is normal. If the air pressure is normal and the barrel is not in upper position, the quantity of liquid is insufficient. The permitted lowering of the barrel due to insufficient liquid is 15 mm. If the barrel is lowered more than 15 mm the ordnance specialist should be advised.

See that there is no dirt on the cylinders of the barrel recuperator and that the piston rods are lubricated and free of dents.

Weight piece. Check to see that the weight piece is properly set and well secured, that the air suction hole is open and that the counterrecoil buffer regulator is screwed in.

Bipod and wheels. Check to see that the bipod is properly connected to the hydro-elastic system, that

the clamps firmly bind the bipod with the wheels and that the wheels are blocked. Make sure that the angle between the elevating mechanism and the barrel is not greater than 85°.

Base-plate. See that there are no cracks on the base-plate.

Sighting device. Check to see that the collimator turns smoothly, that the worm screws of the azimuth and elevating scales turn uniformly without idling. The levels must be unbroken and bubbling, zero intervals of the sighting device and the original sighting line of the rectified sighting device should be firmly set on the bracket.

b) Checking and rectification of the sighting device NSB-1

1. General rules

Defective sighting devices cause certain deflections of hits on the target by individual weapons during firing, due to what the dispersion picture is considerably increased. In order to dismiss this situation or to reduce it to a minimum, it is necessary, from time to time, to check the sighting devices and bring them into proper condition.

Regulator checking of sighting devices is carried out every three months, and also after certain periods of training, prior and after firing and after practise.

Rectification of the sighting device comprises:

- checking the original sighting line
- checking the elevating scale and micrometer, i.e. the longitudinal level.

2. Checking of the original sighting line
(zero position)

The original sighting line is proved then when the white line on the barrel and the vertical slit in the collimator of the sighting device with elementary position of the azimuth scale and micrometer are directed on the same point at a distance at least 4oo metres.

For proving the original sighting line it is necessary to:

- take elementary intervals on the sighting device (azimuth 32-oo, elevation 1o-oo)

- by aiming over the white longitudinal line on the barrel, point the Mortar approximately on the stake or on a conspicuous ground object (post, tree, building) at a distance of at least 4oo metres from the Mortar

- by means of elevating mechanism, lower the barrel to the end and bring the sighting device into cross level position by means of sighting device level

- by means of traversing mechanism, direct the barrel exactly on the selected point by means of the white line on the barrel. To achieve this set the plumb line behind the Mortar and aline the white line on the barrel and the plumb line with the aiming stake. If more precise alignment is desired, it will be necessary to place the battery aiming circle behind the Mortar instead of the plumb line. In this case the aiming stake, the white line on the barrel and the reticle in the eyepiece of the aiming circle should aline

- check the horizontal position of the sighting device by means of the level

- by turning the elevating mechanism, and reading

the weapon, aline the vertical slit in collimator of the sighting device with the aiming point.

In this position, by a proven original sighting line, the azimuth scale should have original intervals, the scale 32, micrometer 0.

If the indicator interval of the azimuth micrometer does not coincide with interval 0, the nut fastener should be loosened two revolutions and the nut of the micrometer knurled ring half a turn and the ring with intervals turned to coincide the 0 interval with the indicator interval; follow up by proving the aim, tightening the knurled nut of the micrometer ring and screwing in the nut fastener, making sure that the aim is not disturbed.

If the scale indicator interval does not coincide with the interval "32" the indicator screws should be loosened half turn and the indicator interval coincided with the interval "32". Unscrewing and screwing on the indicator should be done only in emergency cases and very carefully because frequent unscrewing and screwing may cause their loosening during firing.

Under battle conditions it is not always possible to select a distant aiming point, more so because it should always be tried to avoid moving of the weapon from fire position for the purpose of proving the sighting device.

If a remote aiming point is not available, proving of the sight line may be carried out by means of a board with lines, as follows:

- draw two very visible parallel lines 200-250 mm long and about 5 mm thick, distance between the lines

198 mm, on a wooden board,

- place this board with lines vertically, at a distance of at least 10 metres in front of the Mortar

- direct the barrel white line on the right, line of the board as explained above under sighting on the aiming point

- coincide the sighting device collimator slit with the left line on the board taking care that the cross level bubbles.

By a rectified sighting device the azimuth scale and micrometer should read "32-00". If it does show the elementary position (32-00), the intervals position should be corrected as explained under sighting on aiming point.

3. Proving of the elevating scale and micrometer

Proving of the elevating scale and micrometer, i.e. longitudinal level, is done as follows:

- take elementary interval on elevating scale and micrometer (10-00)

- set the gunners quadrant on the quadrant plate on the barrel and bring the barrel at an angle of 45° by means of the elevating mechanism

- by means of the elevating micrometer bubble the longitudinal level

- when longitudinal level is in bubbling position, the micrometer should read "0" and scale "10".

If the micrometer and scale are not as above indicated, the following should be done:

- loosen the screw fastener and move the screw half turn and coincide the interval "0" on micrometer

with the indicator line

- unwind indicator screw for half turn and coincide indicator line with interval "10" on the elevating scale and tighten the screw.

c) Inspection and preparation of ammunition for firing

1. Assortment of Mortar shells

The shells should be assorted according to types, lots and year of manufacture, and then also according to weight marks in each lot.

The charges should be assorted in propellant lots. This applies both to ignition charges and increments.

2. Inspection of Mortar shells before firing

During examination of ammunition the grease from the shells should be removed and the shell body, fuze and propellant charge should also be examined.

The Mortar shell body should be carefully wiped before firing to remove dirt and grease because it badly influences the burning of the propellant charge. The grease does special harm to the stabilizer and to its through which the ignition charge flame passes.

The fins of the stabilizer should be checked to make sure that they are not bent and that stabilizer is wound to the end and that there are no fissures on the shell body.

The fuze should be checked to make sure that it is screwed in the shell adapter.

The ignition and increment charges should not be allowed to get moistened because in such state they are hard to ignite and burn much slower. Besides great

fails in range may arise.

It is strictly forbidden to stack shells directly on ground and uncovered when prepared for firing, and especially during fog or rain, or in the sun. In rainy weather when handing the shell to the loader, the ammunition server should try to cover the increments with his body.

The propellant bags should be well cared for because if they are torn the propellant will spill and in that case range fails are inevitable.

3. Preparation of shells for firing

When preparing the shell for firing see that increments are tied to the stabilizer so that the knots are symetrically distributed and not piled on each other because if will effect proper burning of the propellant.

If the command is to fire with delayed action, before screwing in, the fuze should be set for delayed action.

During rapid fire the gunner ordered to see that the loader does not drop a Mortar shell in the barrel when there is already one in it or to drop the Mortar shell in the barrel, fuze first.

Never increase the charge above that command nor make any combination with charges at your disposal.

If all prepared Mortar shells are not fired, they should be packed again, as follows:

- remove increments from the shell
- unscrew the fuze and remove [illegible]
- return all elements in their packing.

During the next fire, firstly use shells on which the packings were broken.

d) Observation of the mortar during firing

1. General notes

During firing, proceed as follows:

- check the aim after each firing

- observe the work of hydraulic recoil brake, recuperator and shock absorbers

- watch the position of bipod, i.e. the distance of wheels from base-plate

- see that the traversing screw does not bear on side of the traversing mechanism support

- do not pull abruptly on the lanyard during firing so as to avoid disturbing the aim

- pay attention to the position of base-plate, as explained under "Preparation of ground for the Mortar", [illegible] of site and [illegible] of permitted [illegible] in [illegible] and elevation.

2. Observation of the recoil brake [illegible], recuperator during firing

During firing give special attention to the following function of the recoil brake and recuperators

- that the recoil length is normal

- that the recuperation is without shock and if the recuperation is too fast, adjust the [illegible] buffer regulator on the [illegible] plate

- if the barrel does not return [illegible] it should be pushed [illegible] by hand

3 - [illegible]

[illegible]

be
may carried by its crew.

The tandem tow should be adopted as standard means of transportation of the Mortar and utilized until the ground configuration requires transportation of Mortar in parts loaded on pack-animals.

Motor towing should be used only in special cases, on short distances and the speed must not exceed 15 kilometers per hour on good roads.

The Mortar 12o mm UB M-52-I (with suspension) is motor towed with speeds up to 45 Km/h on good roads, while on bad ones the speed is to be adequately reduced depending on the quality of the road in question. This model doea not possess the necessary equipment for transportation by tandem tow and pack loading.

Quicker and economical method of utilisation of motor vehicles may be achieved if the Mortar is loaded on the vehicle either assembled or disassembled.

One Mortar with ammunition and its crew, may be loaded on a 2 1/2 ton truck.

1. Preparation of Mortars for transportation

(Fig.5o and 51)

To prepare the Mortar for transportation from firing position, proceed as follows:

- bring sighting devices in zero position, remove them from bracket and lay in their boxes
- remove the fuze
- lower barrel in extreme low position with the elevating mechanism
- center the barrel with the traversing gear and coincide the indexes on traversing mechanism support and traversing nut

- set the rough cross leveling mechanism between the lines and tighten with clamp

- fold traversing and elevating crank handles

- lift base-plate from ground, if necessary use tools

- get the wheels nearer to base-plate and insert wheel brackets partly in appropriate clamps on the base-plate and unlock the wheels

- by pressing on the barrel and holding, at the same time, the base-plate with the hydro-elastic system the clamps will fully sit on the brackets; then tighten the clamp

Note: with model UB M-52-I, with suspension, deblock the wheels and suspension by a lever from the weapon set and turn upward by 180° the lock bolt winglet on the biped bracket

- set the lunette in adequate position for transportation desired

Note: With model UB M-52-I, with suspension, only turn the lunette in travelling position and attach on the hook of the prime mover. At hooking, a piece of rubber is to be placed on the lunette and the hook lined therewith. When the rubber fills the empty space between the hook and the lunette, the knocking of the lunette on the hook is eliminated

- put on the weapon cover

- put on the muzzle cover

- insert thill fork in its seat on the lunette and join it with bolt (in case of tandem tow)

- pack the tools and accessories on animals.

2. Tandem tow transport (Fig.52)

For this type of transportation of the weapon two animals are harnessed, one behind the other.

To prepare the weapon for tandem tow from firing position, proceed as follows:

- prepare the Mortar for march
- insert thill fork in its seat on the lunette and joinwith bolt and lock
- insert the thills into the seats on the fork and fix with bolt
- harness the animals
- pack the tools and accessories on the animals.

To harnes the animals, proceed as follows:

- back up the thill animal between the thills and attach thill straps on front ends of thills
- attach the traces to hooks on the thill fork
- attach the breeching straps to triangular thill lugs so that the train may be retained downhill
- pass thill carriers under thills and buckle to ensure that thills are resting on the carriers
- harness the leader animal so that the traces pass through the trace carriers of the thill animal and attach to same hook of the thill fork to which the traces of the thill animal are hooked.

3. Notes for tandem tow transportation

a) In shifting from tandem tow to pack loading two men should hold the base-plate so that the barrel is nearly in horizontal position, and the rest of the crew should detach the barrel from the hydro-elastic system.

This method of detaching of the barrel is much easier than if the base-plate is laid on the ground.

The same procedure should be followed in shifting from pack load to tandem tow or to firing position. By applying this method high lifting of the barrel is avoided and assembling speed is being increased.

b) Going up or down hills in tandem tow, the crew should help the animals by means of ropes hooked to wheel lugs. During such help of the crew the position of the ropes should bealmost parallel with the moving direction.

4. Transportation on pack-animals

The Mortar is being loaded on five pack-animals as follows:

No 1 animal ---------- Base-plate
No 2 animal ---------- Wheels
No 3 animal ---------- Bipod with weight piece
No 4 animal ---------- Hydro-elastic system
No 5 animal ---------- Barrel

a) In order to disassemble the Mortar from firing position for loading, proceed as follows:

- set the sighting devices in their initial position, remove from brackets and lay them in boxes
- lower the barrel in extreme low position by means of elevating mechanism
- center the barrel with the traversing gear and coincide indexes on traversing mechanism support and traversing nut
- fold traversing and elevating crank handles
- remove the weight piece

- lock the trigger by setting the index on "U"
- extract the "U" bolt and lift up the barrel
- set the rough leveling mechanism between the lines and tighten with clamps
- turn and extract the bolts from the traversing mechanism support and release the shock absorber piston rods
- release the bipod clamps, lift up the bipod so that the brackets leave the clamps (this operation should be carried out by three men, one holds the frame*) one wheel)
- lift up the hydro-elastic system vertically and turn it for 90° and separate from base-plate
- lift the base-plate from the ground

b) To prepare the Mortar for firing from pack-load proceed as follows:

- remove the base-plate
- remove the wheels and insert the brackets into the clamps on the base-plate
- remove the bipod and place it on the brackets and tighten
- remove the hydro-elastic system and join it with the base-plate
- connect the bipod to the hydro-elastic system by means of bolts on the traversing mechanism support
- remove the barrel and place it in its seat on the piston rod
- move the collar on the barrel muzzle
- fix the barrel with "L" bolt
- remove the weight piece and fix it in place
- put the crank handles in working position

*) while the other two release the clamps and each holds

- place the Mortar on the prepared ground and set in firing position

- attach the sighting devices

- unlock the trigger and attach the short lanyard

- check the function of traversing and elevating mechanisms

- examine all surfaces subject to friction and lubricate.

c) Description of individual loads

No 1 animal - base-plate (fig.53)

The base-plate is being loaded by four men, two men on each side, so that the ribs of the base-plate are facing upward and the clamps should be turned to the rear save by very broad animals when exceptionally may be turned forward.

The base-plate is being placed on top of the pack-saddle so that the cylindrical projections on the base-plate fall into their seats on the pack-saddle.

The weight of the load is 74 kg.

No 2 animal - wheels (fig.54)

On each side of the pack-saddle one wheel is being hooked with two lugs. The wheels should be placed on the pack-saddle simultaneously. Each wheel is being loaded by one man and the others help getting the lugs hooked up.

On top of the same pack-saddle the gun spares, tools and accessories bag is being loaded.

By No 1 Mortar of the battery on this very animal also the battery set of spares, tools and accessories is being loaded.

The spares, tools and accessories which are being fastened on pack-saddles by means of passing one end of their bag strap through the ring on the front frame and by locking the other end of the strap to the open ring on the rear frame. On this animal also the battery set of spares, tools and accessories is being packed.

The wheels should be loaded on the pack-saddle with the brackets facing forward.

The weight of wheels is 11.50 kg

The weight of spares, tools and accessories is 5.50 kg.

<u>No 3 animal - bipod and weight piece</u> (Fig. 55 and 56).

The bipod is being loaded on the right and the weight piece on the left side of the pack-saddle.

The bipod is being hooked with its rings on the pack-saddle hooks and it is fastened with chains which are being connected to the hooks on the traversing mechanism support and the elevating mechanism body is being fastened with a strap to the middle of the pack-saddle.

The elevating mechanism should be in extreme low position and the projection on the traversing screw should be in the seating on the elevating mechanism casing cover. The crank handles should be folded up.

The weight piece, by means of its rings, is being hooked on the left side of the pack-saddle.

The thill fork is being loaded on top rear part of the pack-saddle with its branches pointing in the direction of the animal. The fork is being fastened on each side of the load with a strap.

The weight of the bipod is 38 kg.
The weight of the weight piece is 38 kg.
The weight of the thill fork is 14.5o kg.

No 4 animal - hydro-elastic system(fig.57).

Before loading the hydro-elastic system, two seatings from the accessories should be placed on the pack-saddle, the lower seating on the front end and the higher one on the rear end. These seatings with their recesses should be fitted on cylindrical projection of the pack-saddle and from the top are being tightened with a nut.

The hydro-elastic system is being loaded on top of the pack-saddle by four men. The front two men use the loading bar on which the hydro-elastic system is supported by projections on the recoil brake cylinder.

The hydro-elastic system is being fastened by means of chain fasteners to the hooks on the projections of the piston rod head.

The thills are being hooked to the pack-saddle, one on each side, with the thill points turned to the rear.

The weight of the hydro-elastic system is 34 kg
The weight of two thills is 11.5o kg.

No 5 animal - barrel (fig.58 and 59)

Before loading the barrel, the pack-saddle should be fitted with two seatings and clamps from the accessories. These seatings are identical and are fitted so that recesses are seated on the cylindrical projections on the pack-saddle and from the top they are tightened with nuts.

The lunette should be moved from the muzzle to the rear, so that with its rear end it should be about 4 cm from the cylindrical swelling on the barrel and well tightened. The cover should be on the muzzle.

The barrel is being loaded by two men and laid with its muzzle pointing forward.

The barrel is being fastened with seating clamps which should be well tightened with wing nuts.

The engineers tools are being loaded on frames fixed to each side of the pack-saddle. These frames are suitable to receive: 2 picks, 1 spade, barrel, cleaner, loading bar and tow ropes.

The weight of the barrel is 71 kg.

The weight of frames with tools is 15.5o kg.

5. Procedure for loading on vehicles

The Mortar may be loaded on motor vehicles assembled or disassembled.

a) An assembled Mortar is being loaded on vehicles by its crew of 5 men, by means of two planks 4 cm thick leaned against the platform on the rear of the vehicle The loading time is about 3o seconds.

During loading one man holds the lunette, which is pointing in the direction of the vehicle, and steers the Mortar, two men are on the wheels and other two men push the Mortar from behind.

After the Mortar is loaded it must be firmly fixed by wedging its wheels from both sides.

If no planks are available, the Mortar may be lifted on the vehicle by 8-1o men.

b) A disassembled Mortar is being loaded according to assemblies arranged on the vehicle so that

there are no contacts between them.

6. Inspection of the weapon before the march

Before starting on a march the following check should be made to ensure that:

- lunette is in the center and well tightened
- traversing and elevating mechanism are in center position
- bipod and base-plate clamps are tight
- condition of the bipod and wheel axles is ood
- sighting devices, spares, tools and accessories set is with the Mortar.

With Mortar model UB M-52-I, with suspension check whether the suspension is blocked and whether it is in good condition. Before travelling, lubricate all jointings on suspension with bearing grease.

7. Inspection during the march

During resting periods and short stops during marching, the following checks should be made to ensure that:

- all clamps are tight
- wheel hubs are not overheated
- all parts are in good condition.

If the hubs are too hot, they should be lubricated or the roller bearings adjusted.

With Mortar model UB M-52-I, with suspension check whether the suspension is blocked and whether it is in good condition. Check whether the lock bolt winglet on the bipod bracket is turned upward in upper position.

VI - DEFECTS AND REMEDIES

Defects on the weapon may arise owing to:

- improper handling and maintenance
- improper servicing for action
- long use.

All defects should be at once reported to the superior who will take necessary steps to have them repaired, because it is the duty of all personnel to keep the weapon in fit condition.

Improper handling is the most frequent cause for defects which may arise; therefore special attention should be given to handling in general and servicing the weapon for firing.

Being that a Mortar is a rather simple weapon and owing to long use of the weapon some defects may arise.

In many cases it may occur that certain defects will not cause a stoppage during action, but as soon as circumstances will permit all inaccuracies should be repaired.

Repairs should be done by trained unit personnel or by specialists.

The unit personnel may carry out minor repairs and replacement of spare parts from the unit set and for all other works to be carried out an ordnance specialist should be consulted. If the Mortar is put in proper condition during periodical inspection, then the need for

specialists will be only in emergency cases.

Defective parts should be replaced from spare parts set and the set should be again completed as soon as possible.

Note: The term "Specialist" means an ordance artizan and "unit personnel" means the crew of the Mortar.

Possible defects that may occur, their probable cause, remedy and authorized personnel to carry out repairs.

Symptom	Probable cause	Remedy	Authorized personnel to make repair
	a) BARREL		
External dents, cuts, scratches on barrel	Mechanical or combat injuries	File off minor scratches	Unit personnel
		If demages are of serious nature, inspect barrel for further use	Specialist
Internal scratches of freezing of barrel	Poor maintenance of barrel or unclean ammunition	Burnish scratched places and inspect barrel for further use	Specialist
White line on barrel not quite visible	Long use	Temporarily touch up with chalk	Unit personnel
		Paint new line	Specialist
Barrel swelling	Improper use	Cease fire	Unit person.
		Replace barrel	Specialist
Charred barrel bore	Long use, improper maintenance	Inspect barrel	Specialist

Symptom	Probable cause	Remedy	Authorized personnel to make repair
b) MISFIRE			
On pulling the trigger no fire	Wornout firing pin	Replace firing pin	Unit personnel
	Weakened or broken striker spring	Replace striker spring	Unit personnel
	Wornout sear catch	Replace sear	Unit personnel
	Unclean mechanism, too much lubricant and soot	Strip and clean	Unit personnel
c) HYDRO-ELASTIC SYSTEM			
Incomplete barrel recuperation	Insufficient nitrogen pressure	Add nitrogen	Unit personnel
	Insufficient quantity of liquid	Add liquid	Specialist
	Damaged sliding parts	Remove scratches	Minor-Unit personnel-large-Specialist
	Sliding surfaces not lubricated	Lubricate	Unit personnel
	Closed counterrecoil buffer	Open regulator	Unit personnel
Excessive play in piston rod head bronze casing	Long use	Replace bronze casings(remount)	Specialist
Barrel recuperation too rapid	Excessive air pressure	Reduce air pressure	Unit personnel
Nitrogen leaking from recuperator	Worn collar jointings	Replace jointings	Specialist

Symptom	Probable cause	Remedy	Authorized personnel to make repair
Nitrogen leaking from recuperator	Loose jointings in collar	Tighten nut	Specialist
Not possible to pump nitrogen into recuperator	Damaged nitrogen pumping valve	Loosen or replace valve needle	Unit personnel
Increased recoil	Worn recoil brake piston guides	Repair piston(remount)	Specialist
Liquid leakage on plug opening	Loose plug on recoil brake cylinder	Trighten plug	Unit personnel
Liquid leakage through recoil brake cylinder nut	Loose nut	Tighten nut	Unit personnel and if necessary call specialist
Liquid leakage along recoil brake piston rod	Loose tallowed wick	Tighten adjusting nut	
Barrel play in collar	Worn collar slides	Replace slides	Specialist
	d) SHOCK ABSORBER		
Excessive sticking out of piston rod from cylinder	Weakened recuperator spring	Replace spring	Specialist
Bent shock absorber piston rod	Mortar not properly placed in battle position	Straighten piston rod cold	Specialist
Shock absorber relaxed	Spring exhausted	Tighten regulating casing	Unit personnel
	e) TRAVERSING MECHANISM		
Great idling	Worn parts	Tighten adjusting nut	Specialist
Bending of traversing screw	Mortar not properly placed in fire position	Straighten traversing screw without heating	Specialist

Symptom	Probable cause	Remedy	Authorized personnel to make repair
f) ELEVATING MECHANISM			
Play in elevating screw	Mechanism body cover loose	Tighten cover	Specialist
g) WHEELS			
Impossible to unlock wheel	Lock bolt bent	Drive out bolt from seat, and if necessary send on repair	Unit personnel
Impossible to lock wheel	Lock bolt bent	Place some thing in front of wheel and send lockig mechanism on repair	Unit personnel
Defects on the suspension (with model 12o mm UB M-52-I			
Knocking of the suspension	Weakened or broken spring	Replace the spring	Specialist
	Rubber buffer worn out	Replace rubber buffer	Specialist
Difficult suspension and heel blocking	Seized wheel blocking	Remove and clean	Unit personnel
Hard working of suspension	Seized axle bolt bearings on suspension	Disassemble suspension with fixture for disassembling and assembling	Specialist

VII - MAINTENANCE OF EQUIPMENT

Inspection Mortar 120 mm UB M-52 and UB M-52-I

The durability of the weapon and its readiness for combat depend on correct handling, maintenance and careful preparation of the weapon for firing. Because of this, it is necessary to strictly adhere to the inspection instructions.

Daily inspection

a.) Inspection prior to use.

The inspection is carried through by the squad commander with the Mortar crew.

The inspection comprises:

a) the completeness of the weapon

b) the correctness of the weapon

As to the completeness check: covers, stakes, brushes and the other pertaining accessories.

For inspection place the Mortar in combat position.

1. Check the barrel and prove that it is empty, clean and in good condition, that on the outer sliding surface there are no abnormal bronze originating from sliding collar.

2. Check the trigger mechanism, by triggering without ammunition in the barrel, and by setting the trigger on rapid fire position, and on locked.

3. Check that the lunette is well fixed on the

barrel and in good condition. If thill seating exists, check its good condition.

4. Check the elevation and traversing mechanism by turning the crank handles.

Check the handles for good condition and check whether the elevation mechanism crank handle, when folded pushes the lock which prevents the turning of the elevating spindle during travelling.

5. Check the function of the shock absorbers by moving the barrel upwards and downwards. The piston rod should protrude from the cylinder for cca 7o mm.

6. Check the suspension for good condition and particularly the blocking of the suspension and wheels on model UB M-52-I.

7. Check the wheels for good condition, that the rubber does not fall of in big fragments and check the adhesion of the tyre to its metal base.

9. Check that the barrel is in its upper position, which shows that there is sufficient pressure and liquid in the hydroelastic system.

lo. Check the thill and its attachment to lunette.

11. For transportation on pack animal check the load seat on the pack saddle and the hook for fastening the load, for correctness.

12. Examine the correctness of all the locks, cotter pins, wire retainers on valves, nuts and screws.

13. After preparation for travelling, the battery commander inspects the correctness of the preparation for travelling.

b) Inspection on march, on stops and on rests

The inspection is carried out by the squad commander and the mortar crew in the following manner:

- during march by observation of the weapon with the purpose of timely perceiving eventual defects

On stops and rests inspect:

1 - that the hubs are not overheated

2 - whether the lubricant is loaking out of the hubs

3 - suspension on model UB M-52-I and tyres for good condition

4 - that the barrel is fastened in the hydro-elastic system

5 - the attachment of the thill to the lunette

6 - whether there is leakage from the hydraulic brake cylinder

7 - whether the clamps on the Mortar base and on the bipod are fastened

8 - that the shock absorber cylinders, or the clamping handle for rough cross levelling do not strike the bipod frame base

9 - give attention to the travelling speed in different atmospheric and ground conditions.

c) Inspection of Mortar after use

The inspection is carried out by the squad commander:

- clean the Mortar and accessories of dust or dirt by a rag and lubricate the unpainted surfaces. The extent of cleaning depends on atmospheric conditions, under which the weapon has been used. This relates to incidents when there was no firing with the weapon.

- place the Mortar and accessories on the place destined for it.

Inspection of the Mortar before firing

Inspection is carried out by the battery commander with his subalterns.

Place the Mortar in combat position on an approximately plain and solid base. If on the exercise-ground there is no such facility, the preparation can be made in a clean closed and sufficiently clear room.

To inspect:

- the completeness of the weapon, covers, stakes brushes, completeness of sighting devices, weapon and battery sets

- barrel - eliminate the lubricant in the barrel by wiping, wipe until the traces of dirt are visible on the rag. Examine the barrel bore for nicks, considerable powder fouling or bitings. Examine the barrel from outside to see whether it is not damaged. Check the quadrant level plate. Lubricate the reinforced part of the barrel which slides in the collar. Check whether the lunette is properly installed and clamped on the muzzle of the barrel. Prove that the barrel is properly fastened in the hydraulic recoil brake. Triggering parts should be properly assembled but lubricated only with thin layer of lubricant.

Check the good condition of the firing pin. Check whether the trigger can easily be placed in position for rapid fire and single shot and on locked.

- elevating and traversing mechanism - check that at turning the handle the spindle nut moves smoothly on the spindle in both directions. When the elevation

spindle is maximally pulled out, there must not be abnormal shaking. Check the good condition of the handle

- cross levelling mechanism - check if the rough levelling mechanism slides on the bipod frame and if the mechanism can be fixed in the desired position, by its clamp. There must not be abnormal shaking in the mechanism slide. Check the proper functioning of the fine cross-levelling mechanism

- shock absorbers - by pressing the barrel check whether the shock absorbers vibrate uniformly and elastically and whether the shock absorber piston rods are properly attached to traversing mechanism

- hydroelastic system - check whether the pressure in the recuperator is normal. Firstly press the barrel downward by artificial recoil. If the pressure is normal and the barrel is not in its upper position, that means that there is not sufficient liquid. It is allowed the barrel to lower, due to insufficient liquid for max. 15 mm. If the barrel should lower for more than 15 mm the specialist is to be informed for refilling the hydraulic brake. Prove that the valve protecting caps on the recuperator cylinder are solidly tightened for sealing. Prove that there are no burns on the recuperator cylinder and bronze spots on sliding surfaces.

Check the hydraulic recoil brake piston rod on good condition and prove that there is no leakage on the brake cylinder casing or on the refilling plug for liquid

- weight piece - examine whether the weight piece is properly installed and safety locked. Check whether, into the weight piece the regulator of the counter

recoil buffer is screwed in

- <u>bipod</u> - check whether the bipod is properly attached to the hydraulic system.

Examine whether the clamps solidly fasten the bipod with the wheels ([illegible]).

Check whether the wheels can be blocked with model UB M-72-I. Prove the turning of the lock bolt [illegible] let on the bipod bracket

- <u>wheels</u> - check the correctness of the wheels by turning them and by examining the tyres check the adhesion of the tyre to metal base

- <u>[illegible]</u> - check the [illegible] and for sliding [illegible] on even ground

- <u>sighting device</u> - check the correct functioning of the collimator, the uniform turning, without backlash, of the worm screws of the azimuth and elevating micrometer. The spirit levels must be complete and bubbling. The sighting device must be rectified and must solidly be fixed in the seating on the bracket, without sliding.

a) <u>Inspection of the weapon during firing</u>

The inspection is carried through by the squad commander and the weapon crew.

1. After every firing carry out the aiming control

2. Observe the function of the hydraulic recoil brake and recuperator, as well as the function of the three [illegible].

Check whether the lengths of recoils are in specified limits.

Observe the counterrecoil of the barrel. The

counterrecoil must be without strikes. If necessary, tighten the counterrecoil buffer regulator on the weight piece.

3. If the barrel has not returned wholly owing to insuficient pressure, lift it by hand in upper position before firing the next round.

4. During cease of fire clean the barrel bore with the brush oiled with gun oil.

5. Check that as a result of firing any attachments have not loosened and that breaking of some parts did not occur, particularly when greater displacement of the Mortar base-plate has been perceived.

b) Inspection of the weapon after firing

The inspection is carried out by the battery commander.

1. After firing, during the barrel is hot, clean the barrel of soot and lubricate with "Askerol".

2. 2-3 hours after firing clean the barrel. If necessary for cleaning use a metal brush too. After cleaning draw through the barrel cleaner, wrapped in a rag.

3. Inspect the barrel and lubricate it. Examine, clean and lubricate the trigger and firing mechanism.

4. In the following two days repeat barrel cleaning once a day.

5. Check the main attachments and assemblies for good condition.

6. Examine the completeness of accessories as well as of weapon and battery sets.

7. Examine the sighting devices.

8. Store the weapon and accessories in the place destined for that.

Weekly inspection

The inspection is carried out by the battery commander with the personnel of his battery.

To every second weekly inspection obligatorily is present the group commander.

The inspection comprizes the ascertaining of good condition of the weapon as a whole and the weapon and battery sets, of books of weekly inspections and of the skill of the crew in maintenance of the weapon.

1. Place the weapon in combat position.

2. Check the traversing and elevating mechanisms for smooth and uniform functioning. Check the solidity of attachment of the traversing spindle nut with the elevating spindle.

3. Triggering and firing parts: check the good condition of triggering parts by pulling the trigger without ammunition in the barrel and by setting the trigger on rapid fire and on locked.

4. Remove barrel from weapon, clean it and check the good condition of the bore. Check that the barrel is not corroded, burnt and that there are no foulings in the barrel. Examine the barrel from outside. Clean it and lubricate the sliding surfaces.

Disassemble the trigger and firing mechanism, clean them and lubricate them with a thin coating.

5. Make certain that the hydroelastic system is in good condition and that there is no leakage of liquid and loss of pressure. Lubricate the sliding surfaces.

6. Thoroughly clean and lubricate all unpainted surfaces on Mortar assemblies and replace the defective

parts existing in the weapon or battery set.

7. After cleaning and lubricating the Mortar assemblies, carry out assembling.

8. Check the weapon and battery set on completeness.

9. Make certain that the sighting mechanism devices are not demaged, clean them and lubricate the unpainted surfaces with a thin coating. Check their accessories.

lo. With model UB M-52-I check suspension on good condition and the possibility of wheel blocking.

11. Check the equipment for pack loading and harnessing.

12. The ascertained condition put down in the book "Weekly inspection" and sign.

13. Make certain whether the condition of Mortar is in accordance with the particulars in the gun book and whether the gun book is filled in correctly and regularly.

I. Technical inspection

This inspection is carried out by the technical squad of the regiment, in presence of the battery and group commanders and their subaltern personnel. The crew cleans the weapon and prepares it for inspection.

The inspection comprises the Mortar as a whole with the pertaining sets and documentation. The inspection comprises the Mortars in service as weel as the Mortars on war reserve stocks, once a month.

Inspection of weapons in service

Place the Mortar in combat position, remove

lunette, check whether the barrel is empty and then examine the attachment of the barrel with the hydraulic recoil brake piston rod.

By checking on functioning, inspect all the Mortar mechanisms in assembled condition. By visual inspection establish the condition of how various locks, seals etc. fit. After obtaining a general impression on the technical condition of the weapon, proceed to detailed inspection of individual devices and parts of the Mortar.

1. Barrel. Clean the barrel with hamp or a rag and if necessary with a metal brush too. Finally draw through several times the barrel cleaner wrapped in a rag till the rag after drawing through remains white, without any traces of dirt and moisture. Illuminate the barrel bore by lighting equipment or white paper and make sure that the barrel is not damaged, bitten or spotty.

2. Trigger and firing mechanism parts

By triggering (without ammunition in the barrel) and by setting the trigger on rapid fire and on locked, prove the condition of the mechanism.

Disassemble the mechanism and check the firing pin on good condition, check the condition of front part of the two-part casing, striker spring, as well as other parts. By gauge inspect the protruding of the firing pin out of the firing mechanism.

Replace the defective parts

Lubricate the mechanisms and assemble them.

3. Lunette: inspect that the lunette is in good order. By turning the lunette bar in its bearing prove that the lunette is not deformed.

4. The traversing and elevating mechanism

By turning the crank handle check for smooth action without sticking. Prove the backlashes and if necessary, eliminate them if they are in extent of a 1/4 of a whole turn.

5. Hydraulic system

Examine all seals on the hydraulic brake cylinder and if necessary, tighten them, Check the index position on the stuffing box of the brake cylinder. Prove whether the protecting caps on recuperator cylinder extension are solidly tightened.

Check the correctness of the shock absorber, the possibility of easy disassembling and assembling of the piston rod with elevating mechanism.

Check the weight-piece and recoil buffer on it.

6. Inspect the connection of all the parts and assemblies and safety of locking.

7. Inspect the wheels on good condition, as well as loops, and loops for pack loading and towing.

8. Disassemble the Mortar to main assemblies-packs, clean the functioning and unpainted surfaces and lubricate them. Lubricate all the lubricators.

9. With model UB M-52-I check correctness of suspension, clean and lubricate unpainted surfaces. Lubricate all the lubricators on suspension.

lo. Assemble the Mortar and carry out artificial recoil. If there are signs that the liquid has leaked and that the pressure in the recuperator is low, undertake checking. Check the liquid with litmus.

Inspect the weapon and battery set on good

condition.

Check and examine the sighting device.

Eliminate the backlashes on sighting device mechanisms.

All the constations-by assemblies-note in the report form on I technical inspection.

WEAPONS IN WAR RESERVE STOCKS

The object of the inspection is to check the completeness of the weapon and the condition of the preservation and to prevent by artificial recoil the withering of the seals. At the recoil check the correctness of the counterrecoil. The inspection is undertaken by the technical squad of the regiment under supervision of battery and group commanders.

II. Technical inspection

The technical inspection is undertaken once a year on all the Mortars in service and on war reserve stocks. The inspection is carried out by the technical squad, and the preparation and cleaning by the unit personnel to whom the Mortars belong. The examination as with the I Technical inspection.

The inspection comprises all the operations as with the I Technical inspection, and besides the following too:

Mortars in service units

1. The examination of quality and quantity of liquid by checking with the litmus paper and by chemical analysis with 10% of the weapons.

2. The checking of the pressure in the recuperator, either by artificial recoil or by pressure messuring.

3. The forcing-out of the old lubricant through the lubricators and the forcing of the new lubricant on jointings and connections as well as on other points to be lubricated.

4. The removing, disassembling, inspection, repair and lubrication of the wheels.

On Mortars in war reserve stocks.

Beside the mentioned, carry out:

Removing of preservative medium and represervation of the barrel with its pertaining mechanisms.

Maintenance of Mortars in service units

The Mortar in service units are placed in closed rooms or under shelters and exceptionally in the open air, in which case beside with covers, the Mortar should be protected with canvas too, if there is possiblity. The Mortar must always be cleaned and lubricated as indicated in the lubrication guide.

The Mortar in service units are stored always completely assembled with released suspension (with model UB M-52-I) and wheels lifted from earth. Place under the suspension bracket wooden blocks with the purpose of releasing the suspension spring. The sighting device must be removed from the Mortar and stored in a closed room on special stand, so as to be lifted from the floor. The same applies for weapon and battery sets of spare parts, tools and accessories.

On the boxes for sighting devices and sets of spare parts, tools and accessories it should be clearly marked to which Mortar they pertain.

In sheds or under special shelters, the Mortars

must be placed in march position so as to be ordered in front and in column, one behind and beside the other, with barrel muzzle pointed to exit. Between the Mortars there must be minimum o,7o m of free space, to render possible cleaning, maintenance and inspection of Mortars. On Mortars which are under shelters or in the open air, the tyres of the wheels must be protected against sun rays, by straw or by an other apt material. If the tyres are for a longer time exposed to the sun rays, they may be coated by a means preventing the influence of the sun rays.

Beside this, the wheels should be turned round their axles from time to time, if at rest for a longer period. For that purpose the wheel is divided and marked in four sectors and every second day it is turned for 9o°.

Care and maintenance of Mortars on storage

The store for keeping the Mortars should render possible:

- proper storing of material
- proper maintenance and protection
- easy supervision and inspection of material
- undertaking of all the maintenance works on the Mortars and - quick handling of the material.

The Mortars on stock must be, prior to stocking thoroughly cleand and lubricated respectively preserved, what depends on the delay, foreseen for storage.

If the Mortars are on storage for a short delay (up to 3 mounths) they are not to be stripped in assemblies nor it is necessary to undertake a special preservation of their parts.

The normal lubrication with gun grease of

unapainted and blackened surfaces suffices. The barrel must be cleaned (washed) and lubricated according to the proceedings separately described.

The Mortars on longer storage (over 3 mounths) can be kept completely assembled or partially disassembled depending on the available storage space, with the understanding that the parts must be grouped around the weapon to which they pertain.

The Mortars and the weapon and battery set of spare parts, tools and accessories which are on longer storage, must be specially preserved. Before preservation the Mortars must be absolutely clean and particularly the parts which have been in touch with powder gases.

The preservation of Mortars and weapon and battery sets is undertaken as follows:

- the barrel is preserved on the unpainted outside surfaces with: "Shell ensis fluid 26o" and the bore with "Shell ensis fluid 25o".

For preserving of all the other unpainted and blackened surfaces of the Mortar, as well as of metal parts of the weapon and battery sets, use "Shell ensis fluid 26o". The chromeplated parts of the hydraulic brake piston rod is not to be preserved.

For lubrication and preservation of ball bearing use ball-bearing grease KLM-3.

For preservation of sighting devices use special grease for instruments.

For preservation of leather parts use "Leather grease" (K-grease).

For lubrication and preservation of inner working surfaces gears, shock absorber cylinders, recuperator

cylinder bore and similar, use gun grease.

For cleaning and preservation works on Mortars and pertaining sets it is necessary to form a group, composed of the following personnel:

- one artillery chief mechanic, who is familiar with weapon in detail

- one artillery mechanic, skilled in disassembling of these Mortars.

- lo solidiers and that:

1 for washing

3 for cleaning

2 for wiping and drying of parts

1 for bringing and carrying away of material

The artillery chief mechanic is in charge of the technical work of the group, organizes the work, cleans the most delicate parts what demands high skill. He obligatorily inspects the cleaned parts before lubrication, effects assembling of the parts and proves the proper functioning after assembling.

The group which undertakes cleaning and preserving must before commencing of the work be taught in practice on materials, how they should work.

With such a group 6-lo of the weapons can be daily cleaned and preserved.

The detailed cleaning and preserving of the weapons on storage must be carried out at least once a year. The removal of old lubricant is performed with rags. The preserving means "Shell ensis fluid 25o and 26o" are removed by wiping with rags dipped in benzine.

The cleaned and preserved mortars should be ordered on storage in front, and in column, one behind

and beside the other, with barrel muzzle pointed to exit Between the Mortars there must be minimum o,7o m of free space, to render possible artificial recoil and inspection of the weapons. The recuperator valves must be easily accessible and after the checking, the valve protecting caps must be solidly tightened and plumbed.

The Mortars must stand on wooden blocks so that the wheels are lifted from the floor, and the suspension (with the model UB M-52-I) released. The Mortars base-plate must also rest on wooden blocks, if the floor in the stocking room is earth.

The sighting devices must be removed from the Mortars and they are kept in their boxes in an other room on stands which are lifted from the floor. The same applies to weapon and battery sets.

The wheel tyres must be absolutely clean so that no foreign substances be on them. Besides, the wheels should be, from time to time, turned around their axles. For this purpose the wheels are divided and marked in 4 sectors and are turned by 9o° every lo days at least.

If on the tyres dark green or dark brown spots are perceived, they should be washed with a mild solution of formalin, and thereafter with water and then dried.

All the other rubber parts which are not on the weapon should be kept in separate, dark room, where the temperature is about 15°. Moisture of air in these rooms should be between 4o% and 6o%.

The tyres of Mortar reserve wheels must be powdered with talcum.

The rubber seals for the weapon must be kept in boxes, powdered with talcum. The rubber seals are to be kept under specified conditions, about 5 years, after which they to be replaced.

Keeping of the gun book

The gun book is used for the enetering of accurate details on the condition of the Mortar and should always be with the Mortar, If the gun book gets lost, the responsible technical. Officer should be informed and the report with all the available data on the weapon and its history should be enclosed, so as to be used when issuing a new gun book.

The gun book is to be filled regularly and precisely. In order to render possible the proper maintenance of the weapon and the pertaining accessories, as well as to avoid doubling of repair and maintenance /the checking and replacement of the liquid/, attention must be paid to the following:

a - enter data on the excuted order for modification as far as they have not been antered. This detail should show the date of execution, and be signed by the officer, responsible for the execution of the modifications,

b - enter particulars on the date of replacement of lubricant and liquid in hydraulic recoil brake, so as to prevent double lubrication, and to make familiar with this condition the person who carries out the inspection,

c - enter details on the number of fired shells and details on barrel bore caliber measuring. The bore caliber should be measured after firing avery 1.000

shells. In case that in the unit a shell has been by error fired with 7 increments, insted of 6, the maximum charge, the measuring of the bore and inspection is to be undertaken before further use of the Mortar.

During inspection of the Mortar it must be proved, whether all the data have been entered in the gun books, which data are to be recorded according to provision and orders for keeping of gun books. Check must be made whether the gun book is regularly kept and whether the condition recorded in the book is on accordance with the condition of the Mortar. In case of non-accordance of details in the gun book with the condition of the Mortar, the details in the gun book must be completed.

VIII

LIST

of weapon and battery sets for Mortar 12o mm UB M-52-I (with suspension for prime mover)

Item No	Denomination	weapon set	battery set
	A. SPARE PARTS		
1.	Firing	1	2
2.	Firing pin spring	1	2
3.	Striker spring	1	2
4.	Tallowed wick 12x12x75o for recoil brake		1
5.	Rubber ring Ø 144x6 of recoil cylinder nut		4
6.	Rubber jointing Ø 32x52x1o for floating piston		4
7.	Rubber jointing Ø 6ox8ox11 for stuffing box		4
8.	Rubber jointing Ø 39,5x47x4,5 for recuperator cylinder		4
9.	Air valve	1	4
1o.	Spirit level for quadrant	1	
11.	Spirit level for sighting device	2	
	B. TOOLS		
12.	Spanner for traversing mechanism		2
13.	Adjustable fork spanner for counterrecoil buffer		1
14.	Double end screwdriver with handle	1	1

15.	Hammer o,5 kg	1	
16.	Wire pliers	1	
17.	Semi-round fine file, 2oo mm		1
18.	Punch	1	
19.	Flat chisel, 2oo mm		1
2o.	Socket wrench for trigger parts	1	
21.	Extracting screw	1	
22.	Socket wrench handle	1	1
23.	Liquid plug wrench		1
24.	Markey wrench		1
25.	Hook spanner for the wheel		1
26.	Fork spanner for brake, bigger		1
27.	For spanner for brake, smaller		1
28.	Wrench for the plug nut of the recuperator cylinder	1	
29.	Screwdriver for sighting device	1	
3o.	Screwdriver small	1	
	C. ACCESSORIES		
31.	Sighting device NS B-1 in wooden box with covering belt	1	
32.	Quadrant in box	1	
33.	Artillery lantern	1	
34.	Lanyard, short	1	
35.	Gun lubricant box, cap.o,5 kg	1	
36.	Oil can, cap o,5 kg	1	
37.	Kerosene can, cap. 1 kg	1	
38.	Box with jointings		1
39.	Bag for spare parts	1	
4o.	Plumb line	1	
41.	Basic charge extracting wrench	1	
42.	Grease gun		1

43.	Pressure gauge up to lo atm		1
44.	Box for pressure gauge		1
45.	Canvas for tools	1	
46.	Bag for weapon set	1	
47.	Lanyard long	1	
48.	Tow rope with hook	2	
49.	Bore brush cover	1	
5o.	Bore brush	1	
51.	Pick	2	
52.	Axe	1	
53.	Spade	1	
54.	Muzzle cover	1	
55.	Weapon cover	1	
56.	Stake	1	
57.	Air pump for filling the recuperator		1
58.	Wrench for fuze	1	
59.	Wrapper for packing battery set		1
6o.	Box for packing weapon set	1	
61.	Camouflage nat, type "U"	1	
62.	Camouflage net, type "R"	1	
63.	Cover for camouflage nets	1	
64.	Firing tables	1	1
65.	Description and handling manual	1	
66.	Gun book	1	
67.	Pressure bottle with nitrogen		1
68.	Flexible armoured hose		1
69.	Suspension spring	2	2

LUBRICATION GUIDE

for Mortars 120 mm UB M-52 and 120 mm UB M-52-I

The lubrication time intervals are based on the service conditions. Reduce the intervals under extreme operating condition in dust, sand, high or low temperature or exposure to moisture. The lubrication intervals may be prolonged if the material is out of service and under favourable storage conditions.

Prior to applying lubricant, clean the lubricators. The lubrication is to be carried out after washing and drying.

By a can with gun oil lubricate daily paintings and connections, handles, catches and disconnectors.

	Point of application	Lubricant interval note		
1.	Barrel bore	TP	D	after cleaning after firing
2.	Outer sliding part of the barrel	TP	D	before firing
3.	Trigger and firing mechanism	TU	W	after cleaning
4.	Outer surfaces of the recuperator cylinder	TU	D	after cleaning after firing
5.	Breech ring seating in the head of the recoil brake piston rod	TP	D	
6.	Cylindrical part of hydraulic brake piston rod-out of cylinder	TU	W	before firing
7.	Spherical socket on the base-plate and ball shaped end of the recoil brake cylinder	TP	D	

8.	Counterrecoil piston rod and cylinder on the weight piece	TU	3M	
9.	Shock absorber piston rod out of cylinder	TP	D	before and after travelling and before firing
10.	Bore of the shock absorber cylinder	TP	6M	
11.	Traversing and elevating mechanism spindles	TP	D	
12.	Elevating mechanism casing: level gears, ball bearing and the bore of elevating mechanism cylinder	LM	6M	
13.	Lubricators on frame brackets	TP	M	before and after travelling
14.	Slide of the rough crosslevelling mechanism	TP	W	-"-
15.	Roller bearing in the wheel hub	LM	6M	
16.	Air pump cylinder and piston	TP	3M	after each filing

TP	Gun grease
TU	Gun oil
LM	Ball and roller bearing grease
D	Daily
W	Weekly
3M	3 months
6M	6 months

2. Cleaning and lubrication of weapon

The purpose of cleaning and lubricating is to relieve the weapon from uncleanliness and old grease and then to protect it with fresh lubricant.

The equipment in units should be regularly cleaned and lubricated because it is constantly exposed to contamination.

The stored equipment should be cleaned and lubricated only at determined intervals of time which must not exceed the stability time of lubricant and means for preservation.

a) Barrel cleaning and lubrication

Firstly clean barrel externally. Remove mud and dirt with water and dry with rags. Do not rub blackened parts, too vigourously.

Normal cleaning of the barrel bore should be done with the barrel cleaner on which a rag is wrapped and which should be changed until the barrel is clean. The cleaner should be passed to the base of the barrel. When it hits the base, the cleaner should be rotated in one direction in order to clean the breech ring face.

Cleaning of barrel after firing, includes pre-cleaning which is done on the firing position and final cleaning is done as soon after as circumstances permit its performance.

The pre-cleaning of barrel consists of lubrication while the barrel is still warm so that the lubricant loosens the soot. To achieve this pass an oiled brush of the cleaner through the barrel several times.

When the barrel is cooled or when circumstances

permit, final cleaning of the barrel should be performed, which is carried out by washing the bore of the barrel.

Before washing, the barrel should be cleaned, and trigger and firing mechanisms removed and the sear recess should be plugged with a rag, and from the bottom side the mechanism casing should be screwed in.

The washing should be done with soap-suds (5-6 litres of warm water plus 5o grams soap) or kerosene (about 3oo grams).

In the course of washing the soap-suds should be changed at least three times and kerosene two times. If soap-suds and kerosene are not available, washing of the barrel may be done with hot water only but washing should be repeated 5-6 times.

Soap-suds or kerosene should be poured into the barrel and a clean brush run through the barrel 5-1o minutes, followed up by spilling out the soap-suds (or the kerosene) and rinsing the barrel with hot water to remove traces of soap-suds. And when kerosene is used for cleaning, only drying with a rag is necessary.

After the barrel is washed it should be thoroughly dried with a dry rag wrapped on the barrel cleaner. The last few strokes of the cleaner through the barrel should be perfomed with a piece of felt wrapped on the cleaner.

Finally a white rag wrapped on the cleaner should be passed through the barrel. After pulling out the rag from the barrel it must not have any stains. In the contrary, the barrel cleaning procedure as explained above should be repeated.

After the barrel has been cleaned a light coat

of gun grease should be applied in the barrel bore by passing a rag saturated in gun grease and wrapped on a dry cleaning brush, through the barrel several times.

Eight days after washing of the barrel, carry out again the normal barrel cleaning without washing and give the barrel its final lubrication.

Cleaning of trigger and firing mechanism. The mechanism should be stripped and its parts immersed in soap-suds or kerosene and then cleaned, dried and lubricated. The mechanism seating, as well, should be cleaned and lubricated.

The lubrication of all parts should be light with gun grease. Excess lubricant may cause stoppages during firing. Cleaning and light lubrication is obligatory after every completed firing.

b) Cleaning and lubrication of hydro-elastic system

Special attention should be paid to cleanliness of hydro-elastic system parts, especially to sliding pieces and the barrel seat.

The parts should never be rubbed with coarse objects to remove the dirt from painted parts. This should be done by washing with water. From unpainted parts removig of dirt should be done with oil.

Only parts subject to friction should be lubricated.

c) Cleaning and lubrication of shock absorbers

Cleaning and lubrication of shock absorber parts should be done by specialists only.

Old grease should be removed by washing, parts should be throughly dried and greased with a heavier coat

of grease.

If corrosion is discovered, it should be carefully removed with kerosene.

Changing of grease should be done during general cleanings.

d) Cleaning and lubricating of traversing and elevating mechanisms

Cleaning and lubrication of external parts of these mechanisms should be performed by unit personnel without stripping, while the general cleaning, for which it is necessary to strip these mechanisms, should be done a specialist.

The parts subject to friction and sliding should be clean and lightly lubricated with gun grease.

When cleaning the internal parts, the specialist should do the stripping, cleaning, examining and lubricating with gun grease.

If any traces of corrosion are discovered on internal parts of the mechanism, they should be carefully removed with kerosene and then the parts should be thoroughly dried and lubricated.

e) Cleaning and lubrication of wheels

Externally, the wheel should be cleaned by washing with, water and save the brackets, none of external parts should be lubricated.

Care should be taken that kerosene and lubricant do not come in contact with the rubber tyre.

For general cleaning of internal parts, the wheel should be stripped by a specialist. After removing the wheel, the roller bearings should be driven out and

put in warm soap-suds to remove old grease. From inside of the wheel remove grit and contaminated grease, clean the inside and lubricate with gun grease. When re-assembling make sure the wheels come on proper sides.

f) Cleaning and lubrication of bipod and base-plate

Cleaning of bipod and base-plate should be done by washing and drying with rags.

Only internal parts and clamp screws and the ball seat socket on the base-plate should be lubricated.

g) Cleaning of sighting devices

The sighting device should be cleaned with a soft rag and should not be lubricated. The dust should be removed with a soft brush. Be careful that glass and lens do not come in contact with lubricant.

General cleanings requiring stripping of the device, should be done by specialists.

h) Cleaning of weapon covers

The weapon covers should be cleaned by washing in lukewarm water and thoroughly dried before placed on weapon.

It is strictly forbidden to place washed covers on the weapon to dry.

IX - HANDLING THE RECUPERATOR AIR FILLING PUMP

Pumping air into the recuperator is carried out with a foot operated pump from the battery accessories set.

To pump air into the recuperator, proced as follows:

- unwind the rubber tube from the pump and unlock the pump by pulling the catch which holds it in folded position

- check by hand to ensure that the rubber tube is screwed tight to the pump body. If loose, screw on as far as it will go to tighten the leather jointing on the rubber tube

- set the fitting of the rubber tube on the valve body of the recuperator. Before setting, check to ensure that the fitting clamp lever is in the direction of the valve body

- press the lever against the tube for 90° to obtain good sealing of the fitting and the tube

- pump air into the recuperator by foot (as shown on figure 69) until pressure of 9 atm is reached. For obtaining this pressure about 350 strokes of the pump are needed

- on the other recuperator valve check the pressure with the gauge from the battery set of spares, tools and accessories. The gauge should be pressed flush on the vlave body point and valve needle so that no air excapes.

Read the pressure on the gauge scale

- when pressure of 9 atm is reached, the rubber tube fitting clamp lever should be set in direction of the recuperator body and the fitting and the rubber tube detached from the valve body

- let the pump cylinder cool, fold the pump and secure with catch

- wrap the rubber tube about the pump and return to its place in the battery set.

Note: during compressing air into the recuperator attention should be given to the following:

- if after several strokes you find that the pump is not labouring, check to see if the pump piston leather jointing is in order by removing the upper cover of the pump cylinder and extracting the piston. If the leather jointing is undamaged, it should be widened by hand, greased and assembled again. If the jointing is damaged it should be replaced

- if you feel that the pump labours too hard during pumping, check the valve needle to see that it is not too tight or that the valve on the bottom of the cylinder pump is not damaged. In the former case loosen the valve needle with the valve cap and in the latter remove the screw closing the valve on the pump body and check to see if it is clean. If there is dirt in the valve, seat clean the valve.

Before cleaning the seat take out the valve spring and pellet. After cleaning return the pellet and spring in the valve seat and screw-in the screw tightly to ensure sealing of the pump on this place by means of the leather washer on the screw

Periodically the pump cylinder should be greased with fat or leather tallow.

Parts of the pump subject to friction should be oiled before pumping. After using, the pump should be cleaned folded and returned to its place in the battery set. The air gauge should be checked for dents or injuries before using as to ensure proper gauging.

The following figures are missing:

Figure 36, 66, 67, and 68.

SECRET
NO FOREIGN DISSEM

RESTRICTED

PROJECT

120 mm MORTAR UB M 52

DESCRIPTION, OPERATION AND MAINTENANCE MANUAL

FIGURES

SECRET
NO FOREIGN DISSEM

SECOND EDITION

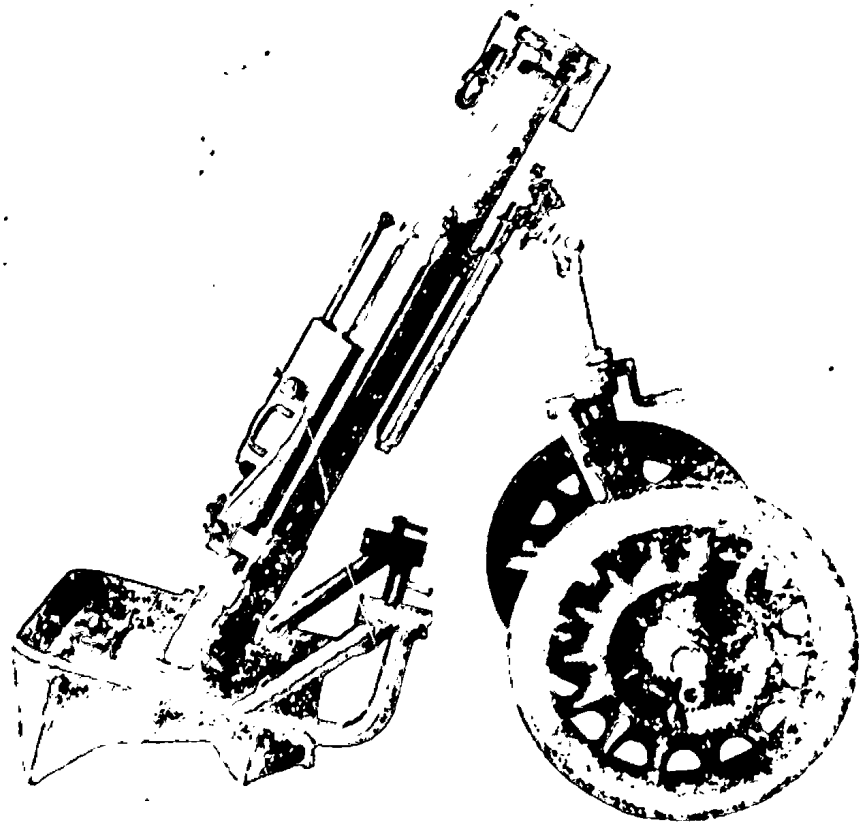


Fig. 1 — Mortar 120-mm UB M52 — General view

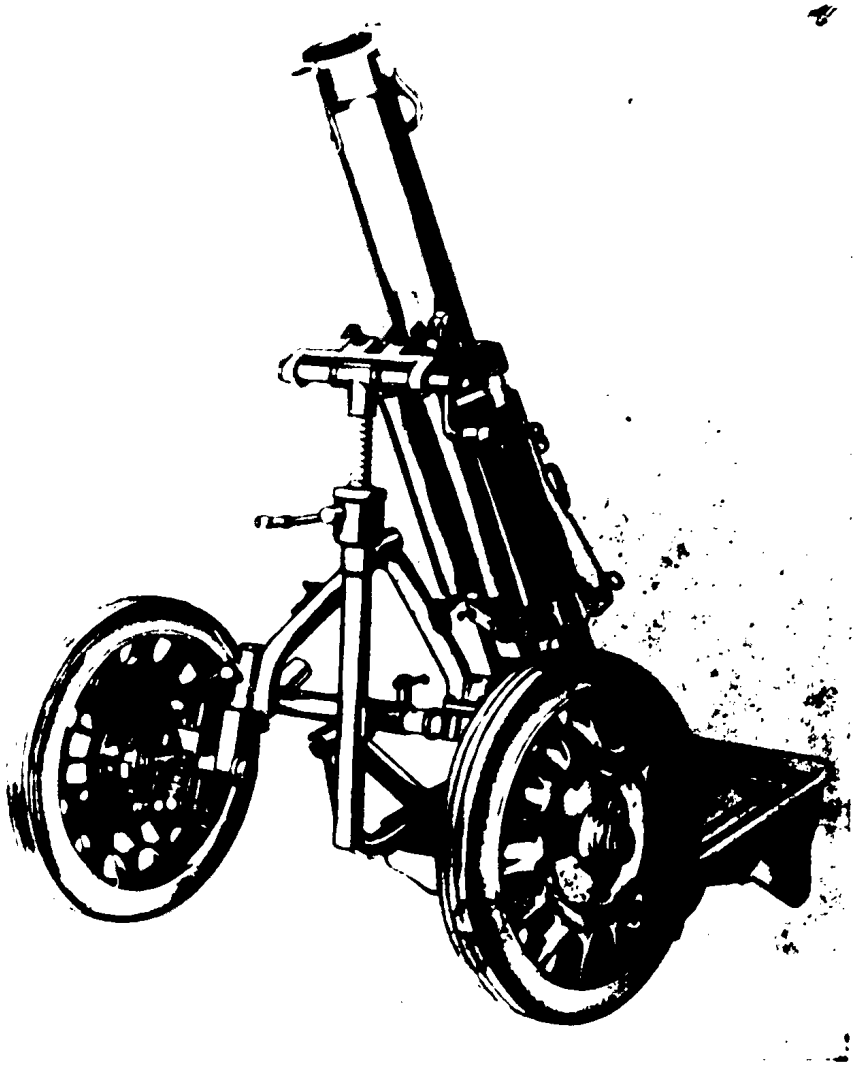


Fig. 1a — Mortar 120-mm UB M52 -I- with suspension for motor towing

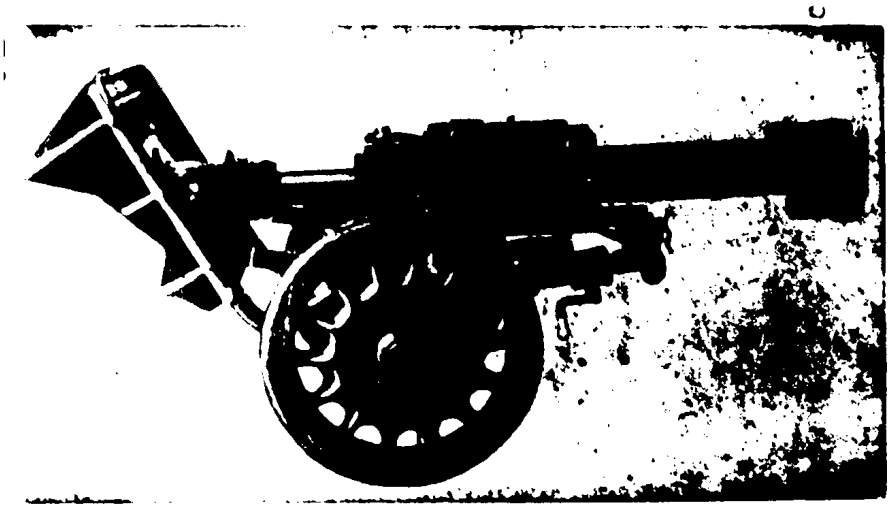


Fig. 2 - Mortar 120-mm UB M52 — Transport position

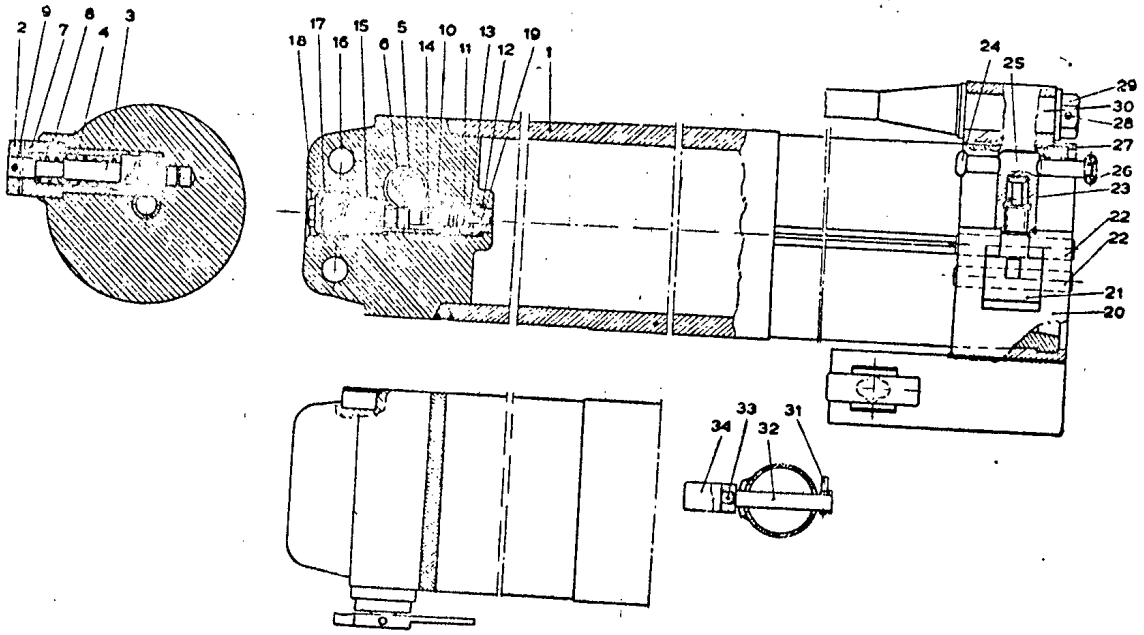


Fig. 3 — Barrel assembly, trigger and firing parts and lunette
(nomenclature of parts on the next page)

a) **Barrel assembly and breech — ring**

1 — Barrel with breech-ring

b) **Trigger mechanism assembly**

2 — Trigger
3 — Trigger shaft
4 — Trigger retracting spring
5 — Sear
6 — Sear spring
7 — Trigger mechanism casing
8 — Casing fastening pin
9 — Trigger fastening pin

c) **Firing mechanism assembly**

10 — Firing mechanism two part casing — rear
11 — Firing mechanism two part casing — front
12 — Copper jointing
13 — Firing pin spring
14 — Striker
15 — Support casing
16 — Striker spring
17 — Striker spring support nut
18 — Firing mechanism fastening casing
19 — Firing pin

d) **Lunette assembly**

20 — Lower half of lunette ring
21 — Tightening screw
22 — Shaft
23 — Pin
24 — Clamp hand grip
25 — Clamp hand grip
26 — Hand grip nut
27 — Upper half of lunette ring
28 — Pin
29 — Nut
30 — Lunette bar

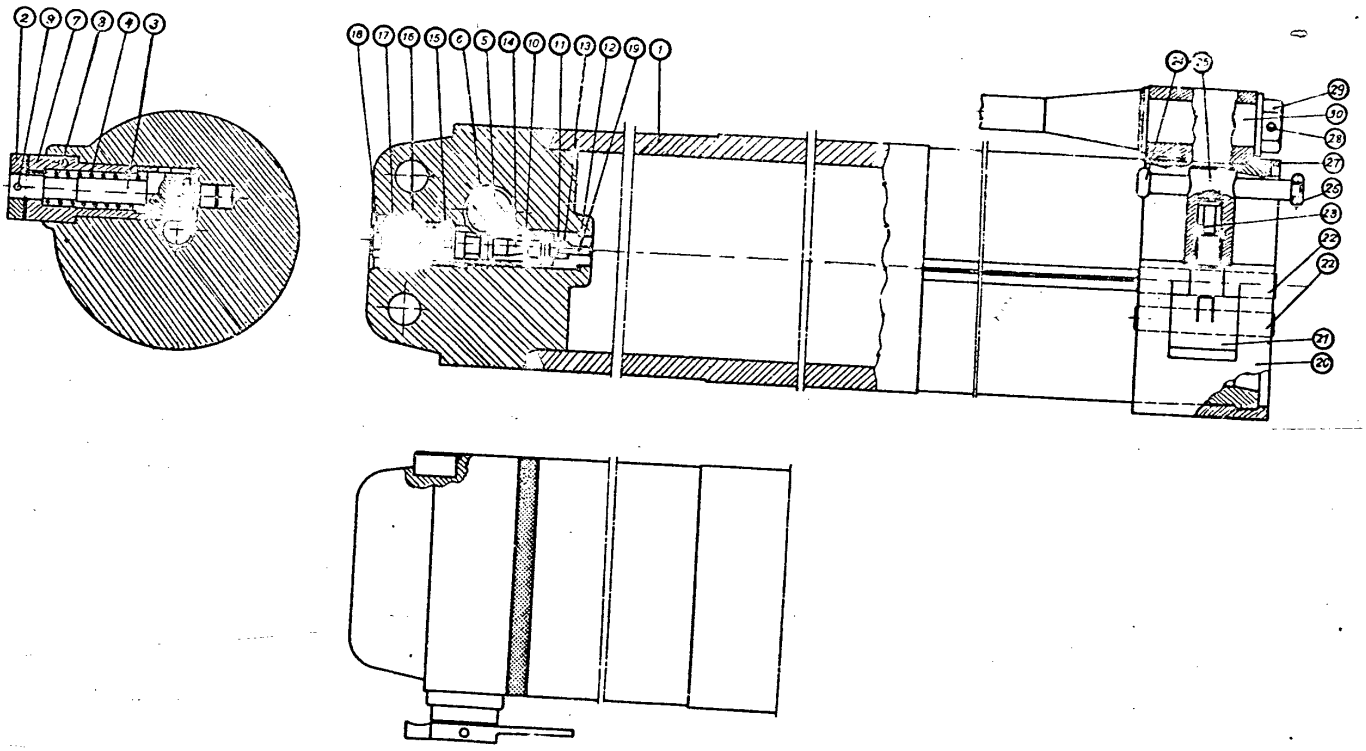


Fig. 3a — Barrel assembly with lunette for motor towing of the mortar 120-mm UB M52-I

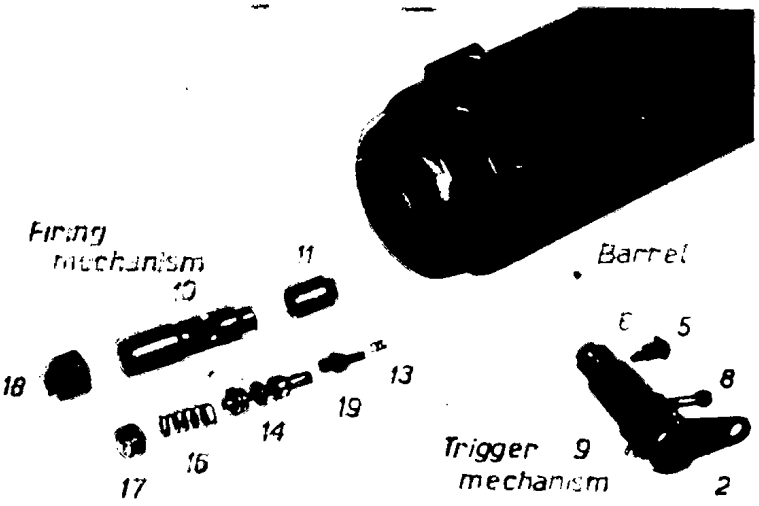


Fig. 4 Barrel with trigger and firing mechanisms' parts

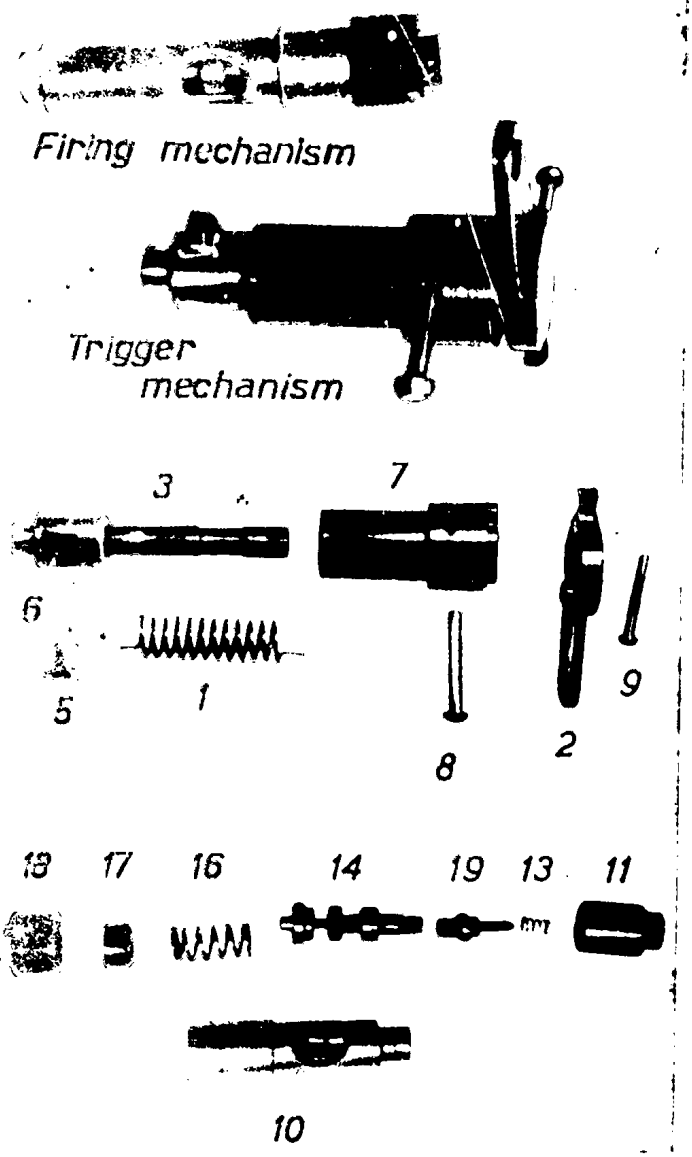


Fig. 5 — Trigger and firing mechanisms' parts

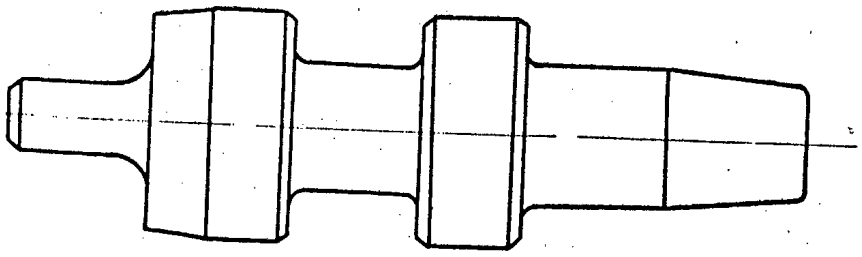


Fig. 5a — Striker

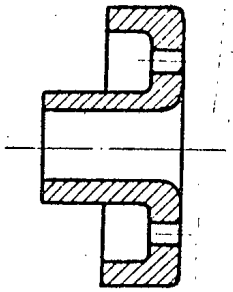


Fig. 5b — Supporting plate

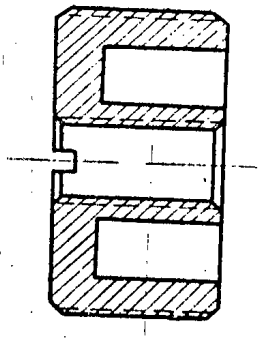


Fig. 5c — Nut

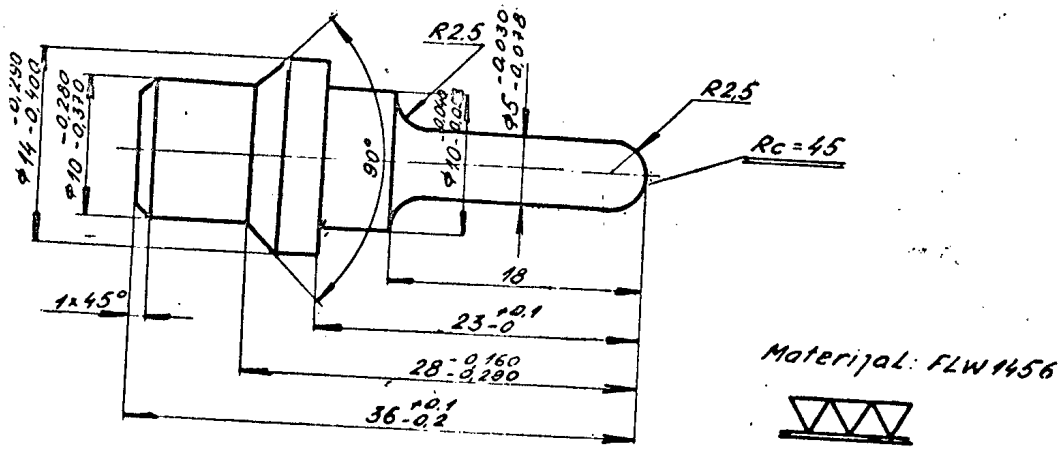
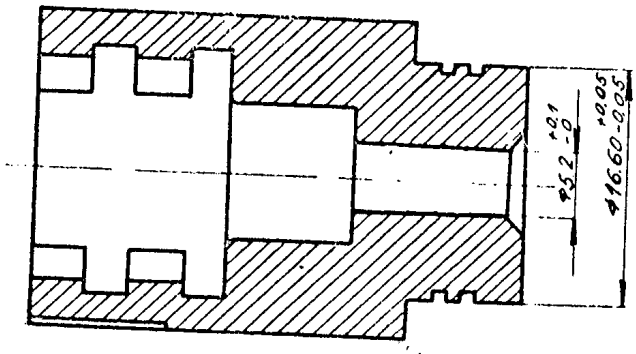


Fig. 5c — Firing pin



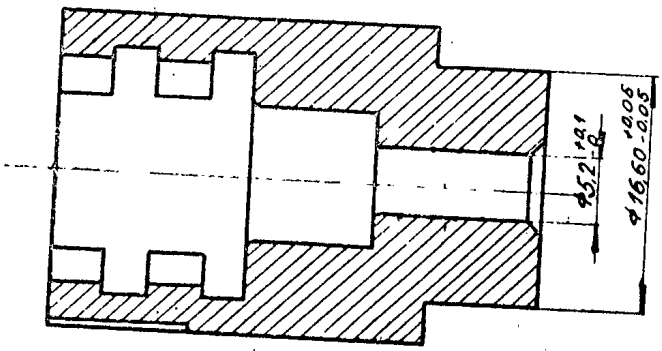


Fig. 5d — Front part of two-part casing

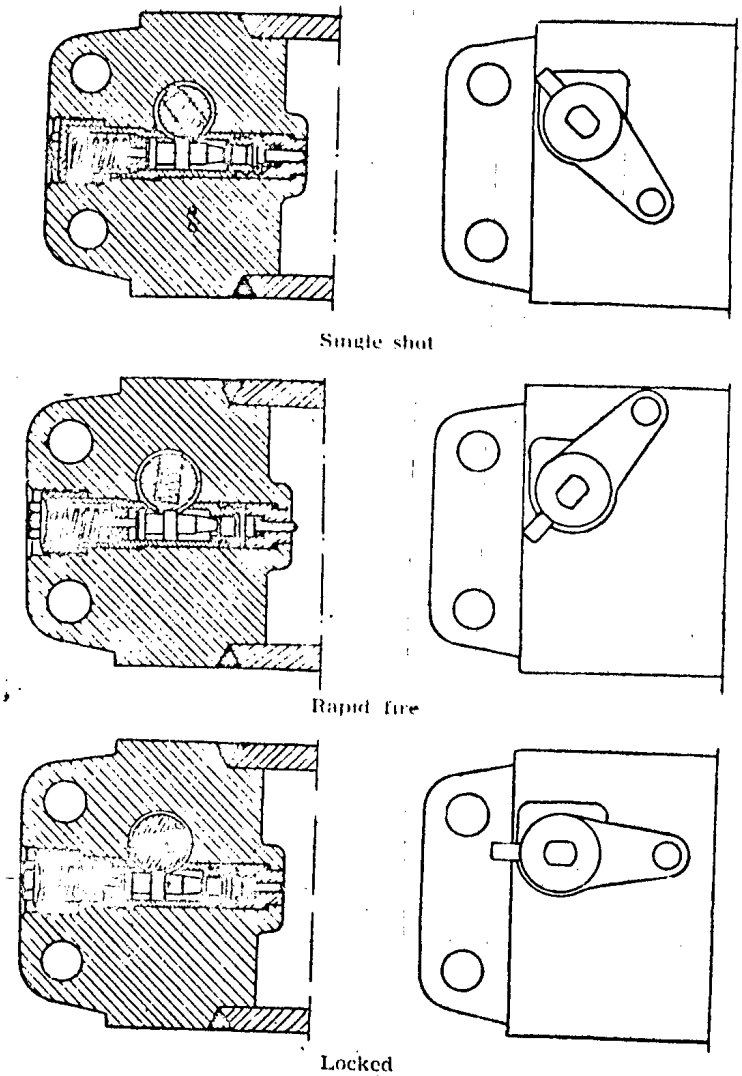


Fig. 6 — Trigger and firing mechanisms' parts in position for single shot and rapid fire and in locked position

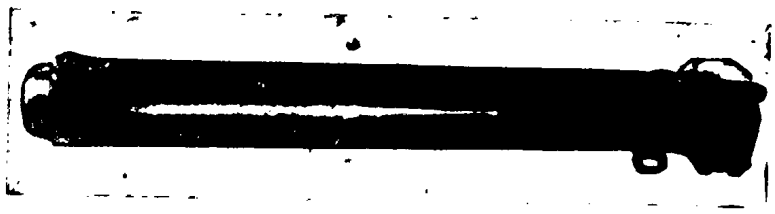


Fig. 7 — Barrel with lunette

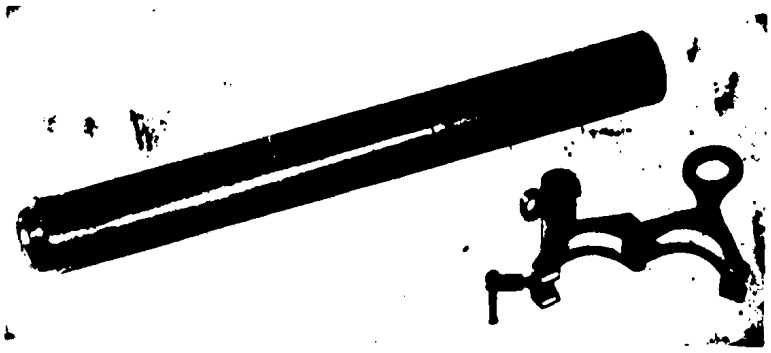


Fig. 8 — Towing lunette

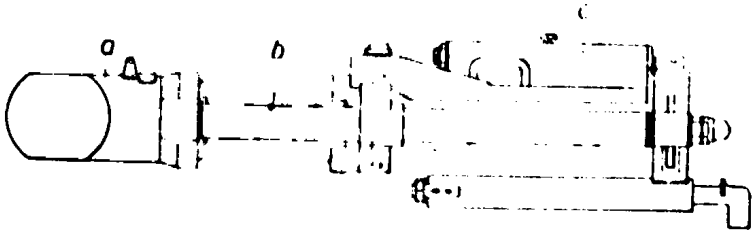


Fig. 9 — Hydro-elastic System — Assembly

a) Recoil brake cylinder
b) Piston rod
c) Weight piece
d) Shock absorbers

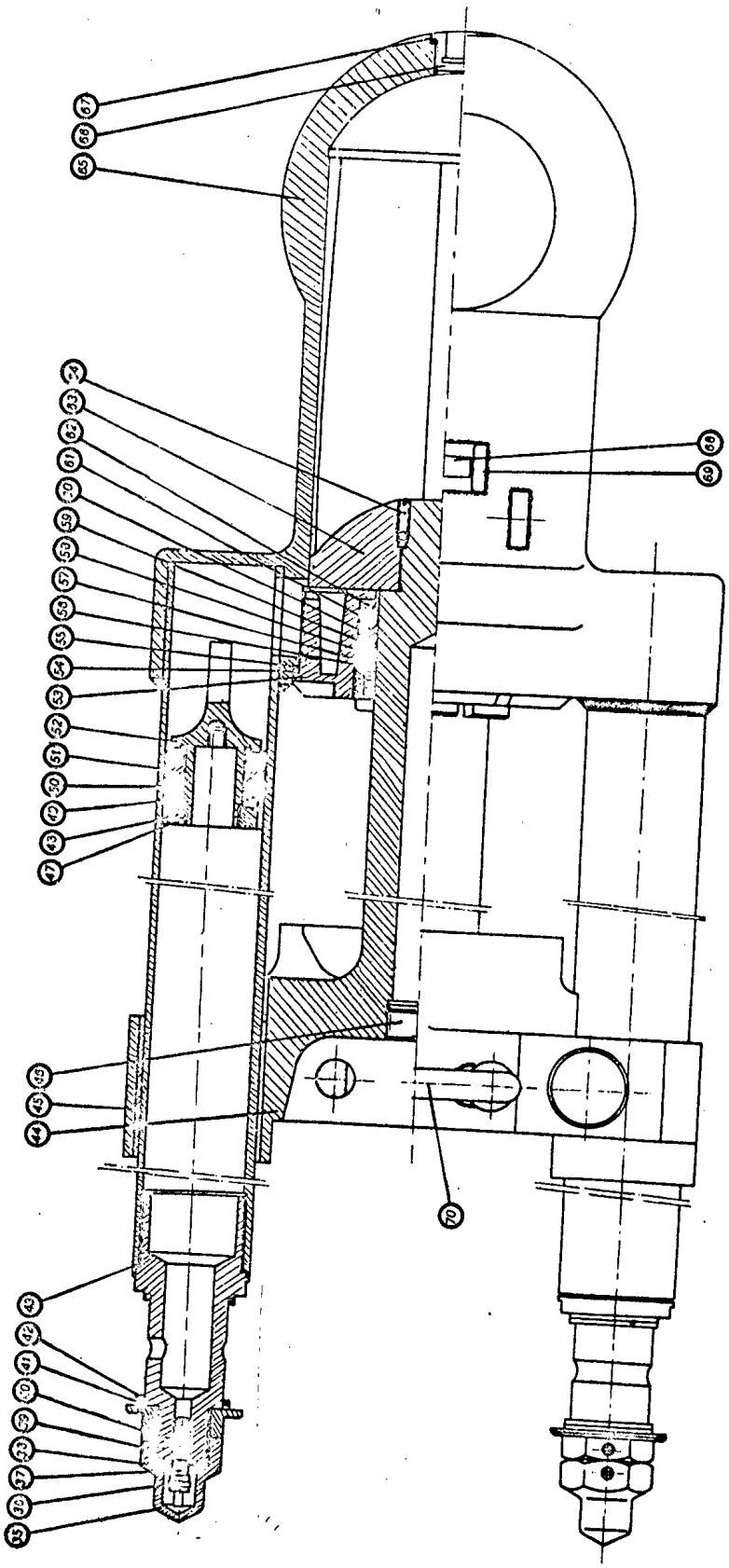


Fig. 10 — Hydraulic recoil brake and recuperator (nomenclature of parts on the next page)

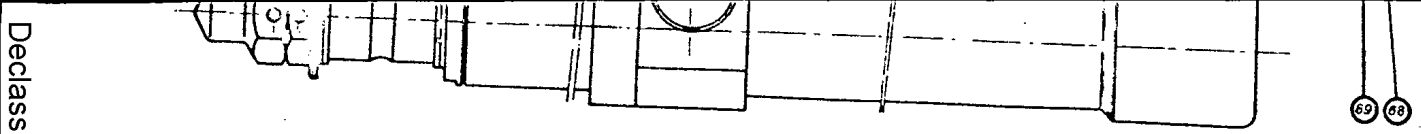


Fig. 10 — Hydraulic recoil brake and recuperator (nomenclature of parts on the next page)

35 — Protecting cap
36 — Valve cap
37 — Valve body with needle
38 — Fiber jointing
39 — Protecting cap safety screw
40 — Recuperator cylinder extension
41 — Steel washer
42 — Collar rubber jointing
43 — Recuperator cylinder copper jointing
44 — Recoil brake piston rod
45 — Piston rod bronze casing
46 — Piston rod plug
47 — Floating piston nut
48 — Floating piston nut safety screw
49 — Steel ring
50 — Leather jointing
51 — Tween ring
52 — Piston body
53 — Recoil brake cylinder nut
54 — Steel washer
55 — Rubber jointing
56 — Felt wiper
57 — Regulating nut
58 — Wick pressing ring — upper
59 — Tallowed wick
60 — Wick pressing ring — lower
61 — Leather ring
62 — Steel ring
63 — Recoil brake piston
64 — Recoil brake safety screw
65 — Recuperator cylinder
65 — Recoil brake cylinder
66 — Recoil brake cylinder plug
67 — Recoil brake cylinder copper jointing
68 — Lanyard ring casing
69 — Lanyard ring pin
70 — »U« bolt

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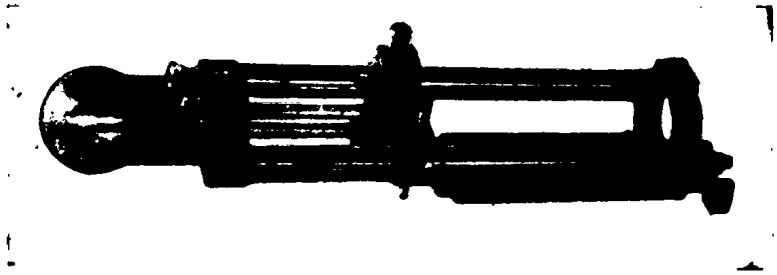


Fig. 11 Hydro-elastic system assembly View from above

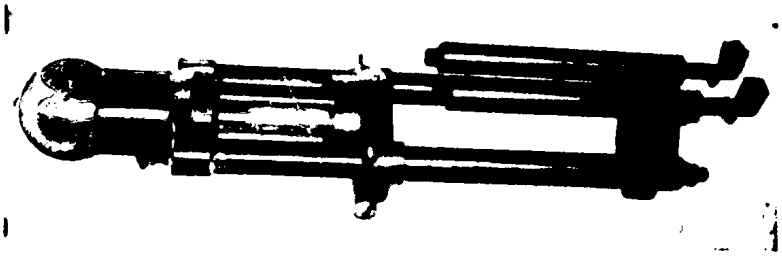


Fig. 12 Hydro-elastic system — View from underneath

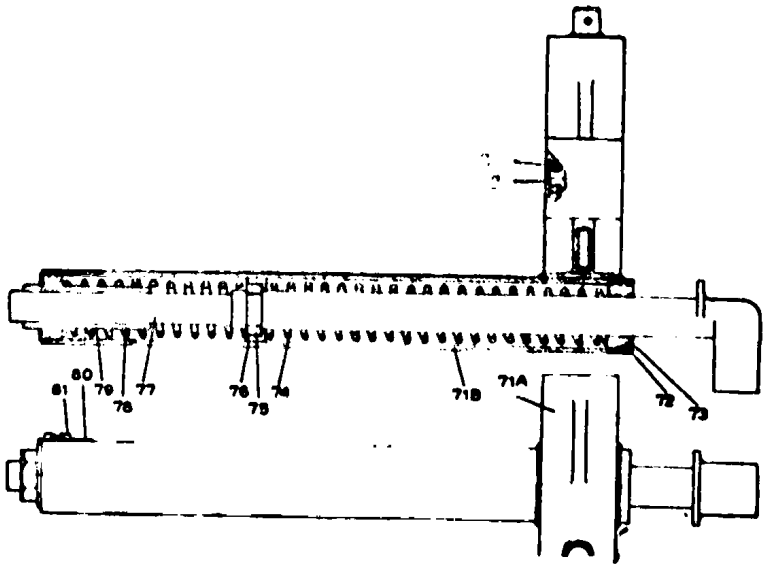
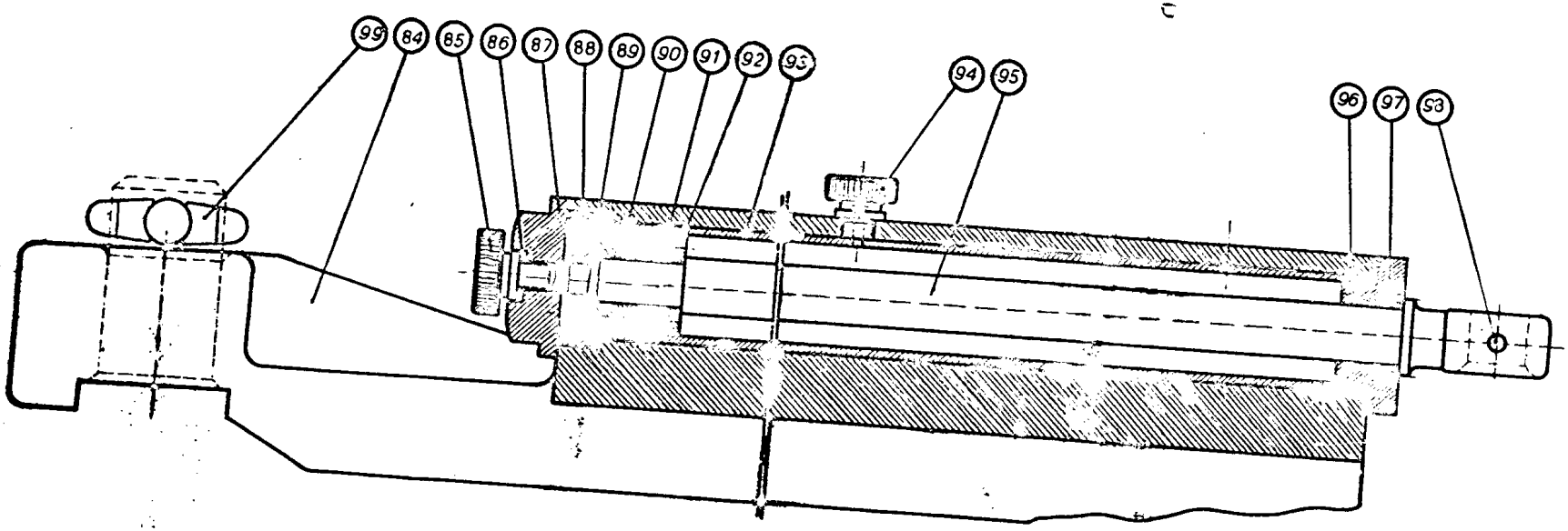


Fig. 13 Shock absorber assembly

71a — Collar
71b — Chock absorber cylinder
72 Safety screw of upper bronze casing
73 — Upper bronze casing
74 — Shock absorber spring long
75 — Two part ring stop
76 — Bronze casing
77 — Shock absorber piston rod
78 — Shock absorber spring short
79 — Lower regulating casing
80 — Nut lock
81 Nut lock screw
82 — Collar bronze slide
83 — Collar bronze slide screw



84 — Weight piece body
85 — Counterrecoil buffer valve screw
86 — Rubber jointing
87 — Counterrecoil cylinder lower cover

Fig. 14 — Weight piece assembly

88 — Piston nut
89 — Safety screw
90 — Counterrecoil piston
91 — Leather ring
92 — Washer

93 — Counterrecoil piston rod
96 — Cylinder nut
97 — Piston rod guide
98 — Piston rod guide bolt
99 — Weight piece bolt

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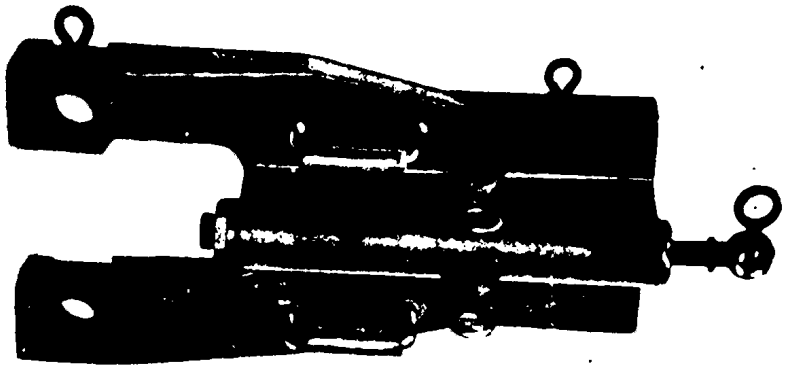


Fig. 15 Weight piece — View from above

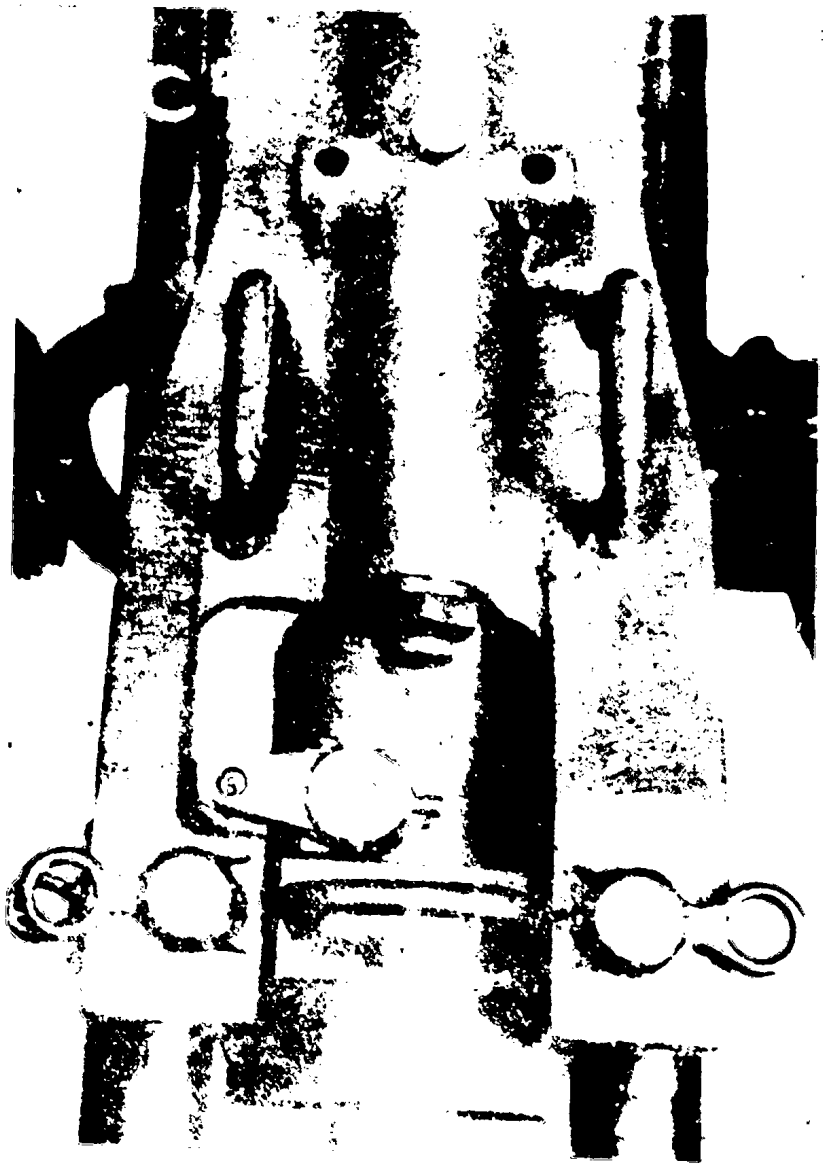


Fig. 16 — Weight piece mounted on the weapon

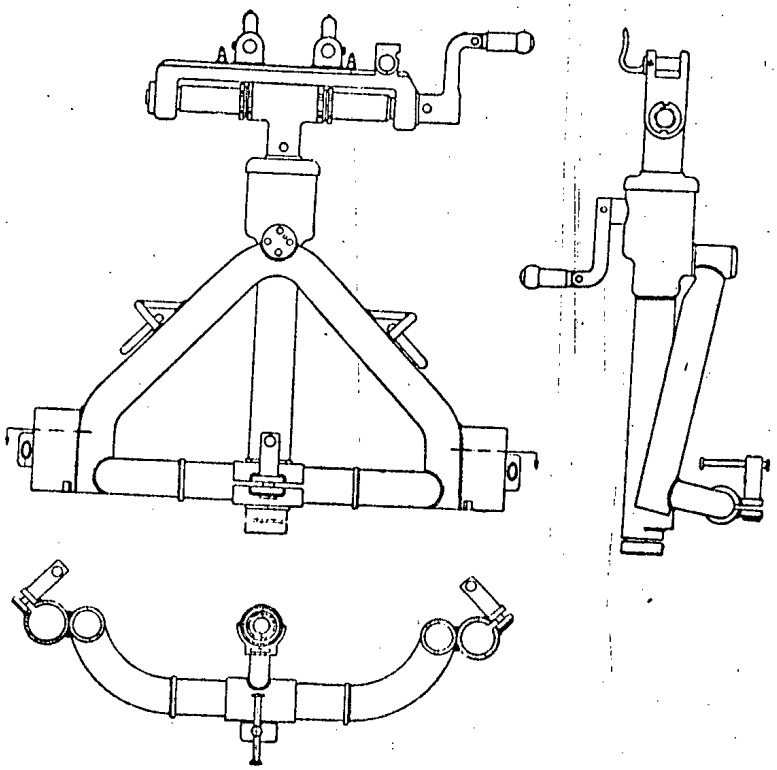


Fig. 17 — Bipod Assembly — General view

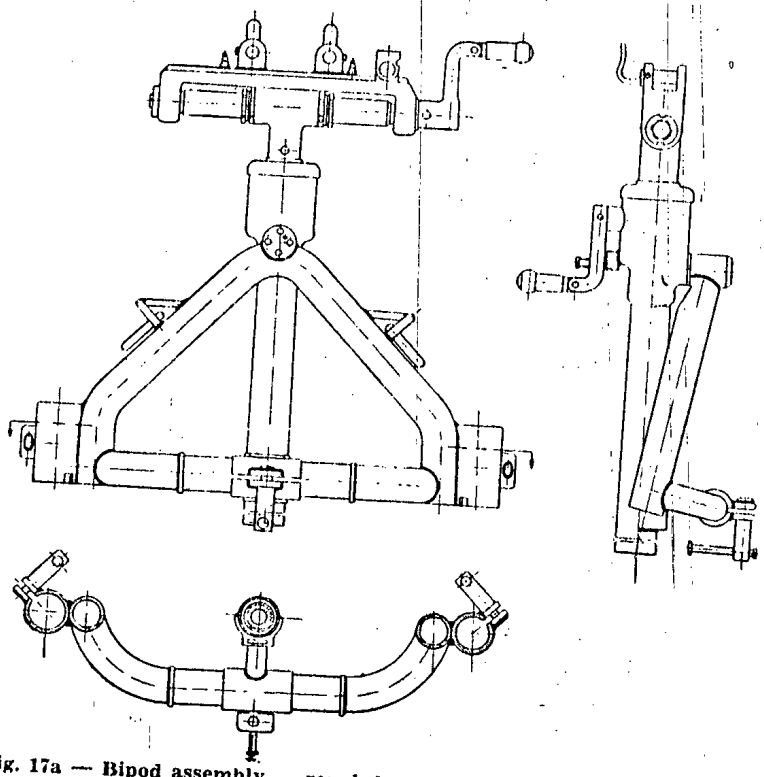


Fig. 17a — Bipod assembly — rough leveling mechanism, turned for 180°

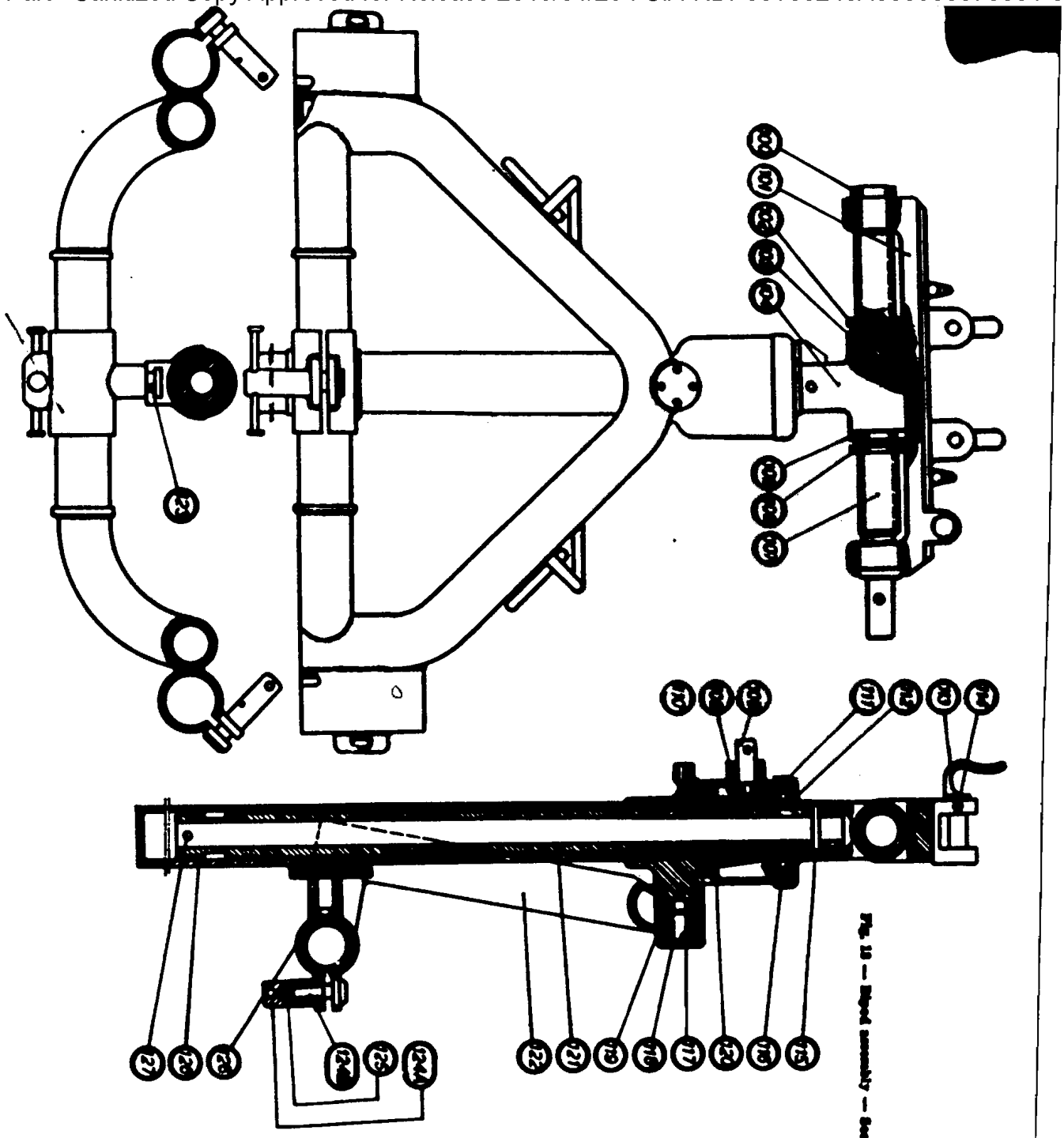


Fig. 18 — Sight assembly — Section (nomenclature of parts on the next page)

100 — Traversing mechanism
101 — Traversing mechanism screw nut
102 — Traversing mechanism support
103 — Traversing mechanism screw regulating nut
104 — Lock nut
105 — Traversing nut
106 — Traversing mechanism screw regulating nut
107 — Traversing mechanism screw
108 — Traversing mechanism bevel gear
109 — Elevating mechanism body
110 — Ball bearing
111 — Elevating nut
112 — Elevating mechanism body cover
113 — Shock absorber piston rod bolt
114 — Stop screw
115 — Pin
116 — Elevating mechanism body cover screw
117 — Safety screw
118 — Bipod frame screw
119 — Two part bronze casing
120 — Spacing washer — elevating nut
121 — Elevating screw
122 — Bipod frame
123 — Rough cross leveling mechanism slide
124 — Clamp screw casing
124a — Clamp screw
125 — Pin
126 — Elevating screw bronze casing
127 — Pin
128 — Pin

Fig 18

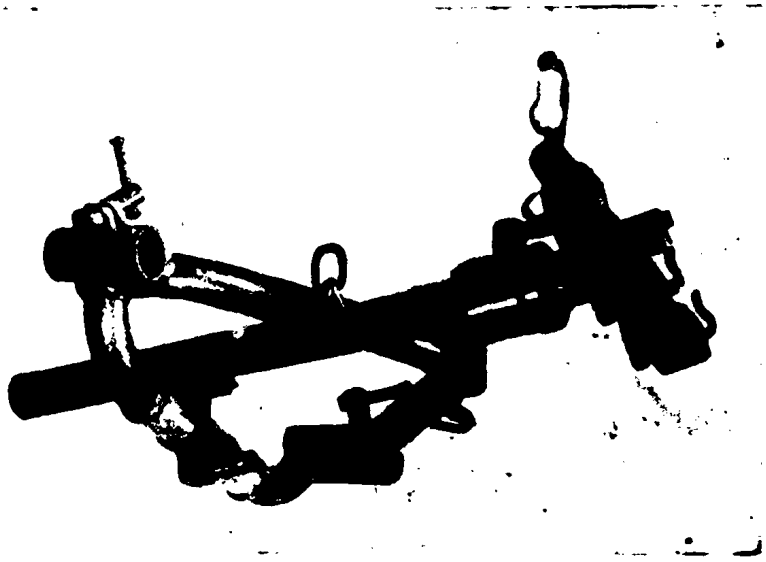


Fig. 19 — Bipod — Rear view

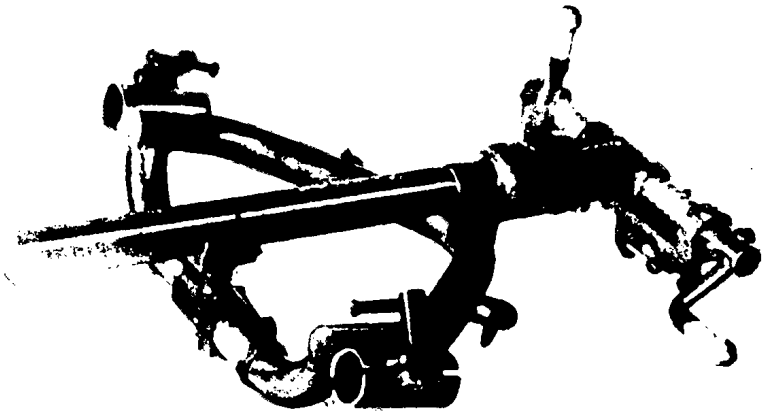


Fig. 20 — Bipod — Front view

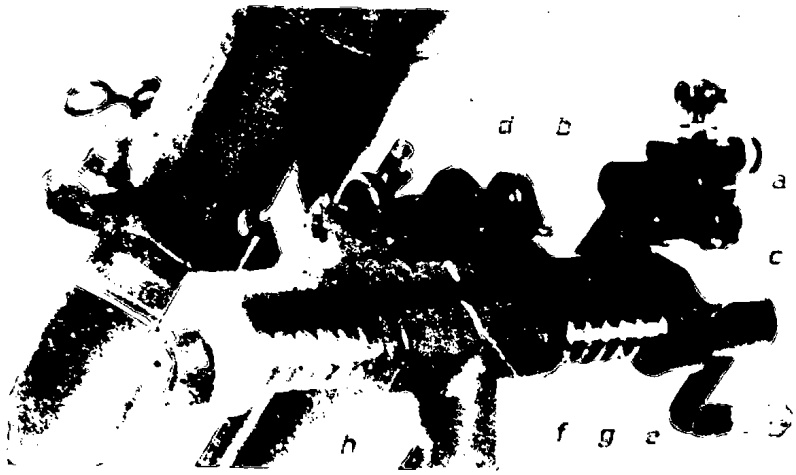


Fig. 21 — Barrel traversing mechanism

129 — Pin
130 — Crank body
131 — Crank joint pin
132 — Shaft
133 — Hand grip
134 — Spring
135 — Crank bushing
136 — Plate

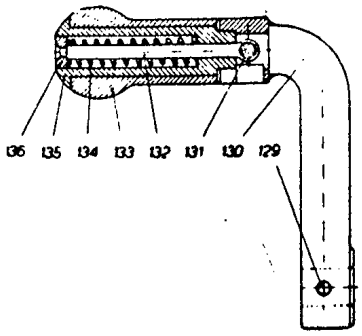


Fig. 22 — Traversing and elevating mechanism crank handles

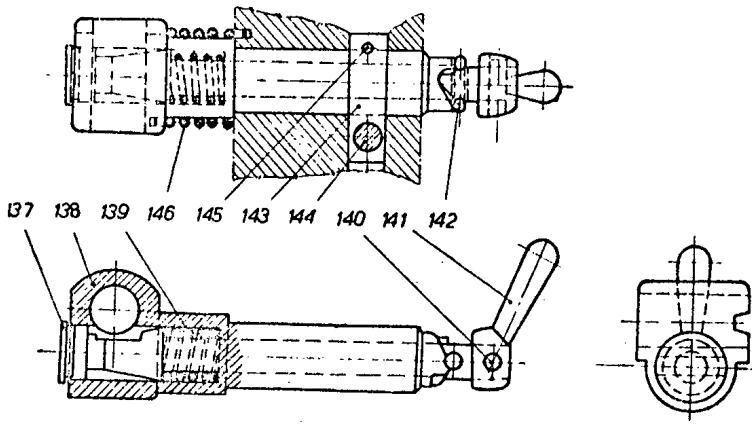


Fig. 23 — Sighting device bracket

137 — Sighting device bracket body
138 — Bracket shaft
139 — Pushing spring
146 — Retracting spring
145 — Plate screw screw
143 — Precise cross leveling plate
144 — Precise cross leveling plate
140 — Pin
141 — Bracket handle
142 — Pin

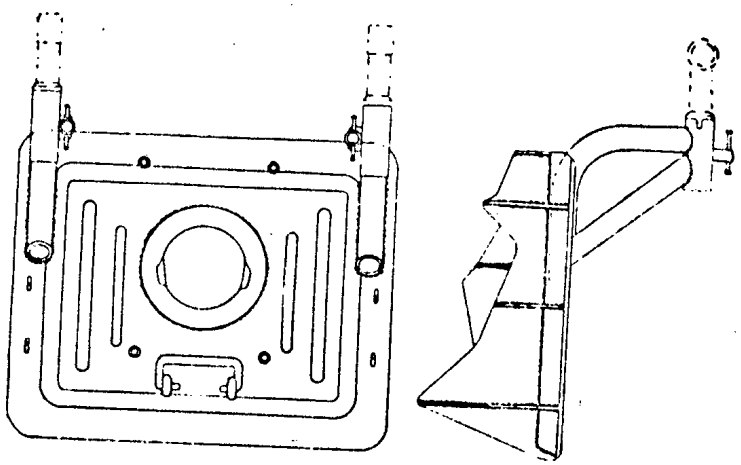


Fig. 24 — Base plate assembly, without stop

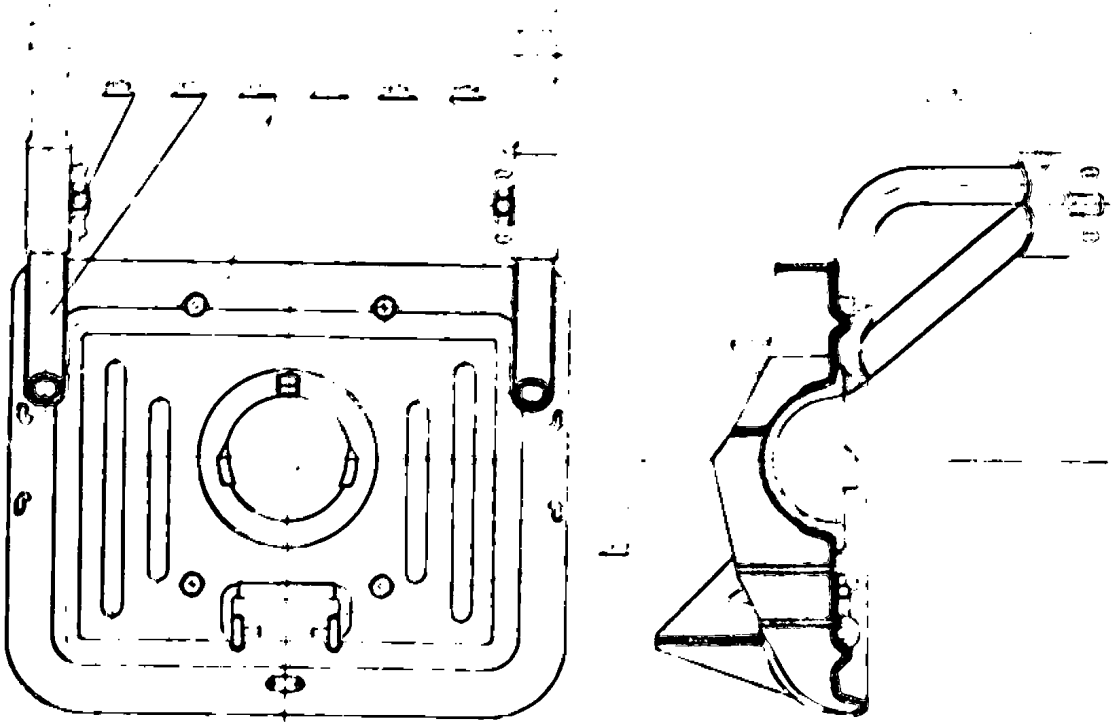


Fig. 24a — Base assembly with step

147a	Wheel bracket fixture — right	147d	Fixture bracket
147b	Wheel bracket fixture — left	147e	
147c	Base bracket	147f	
		147	Base plate

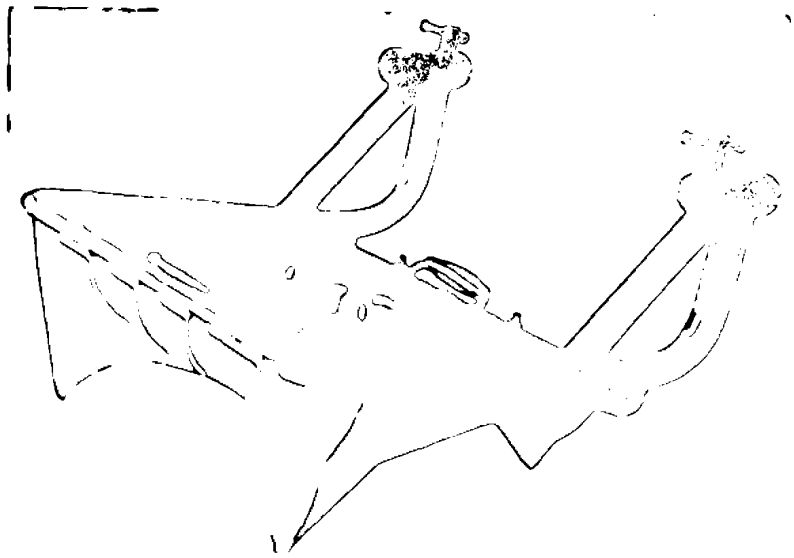


Fig. 23 — Base plate assembly, with step

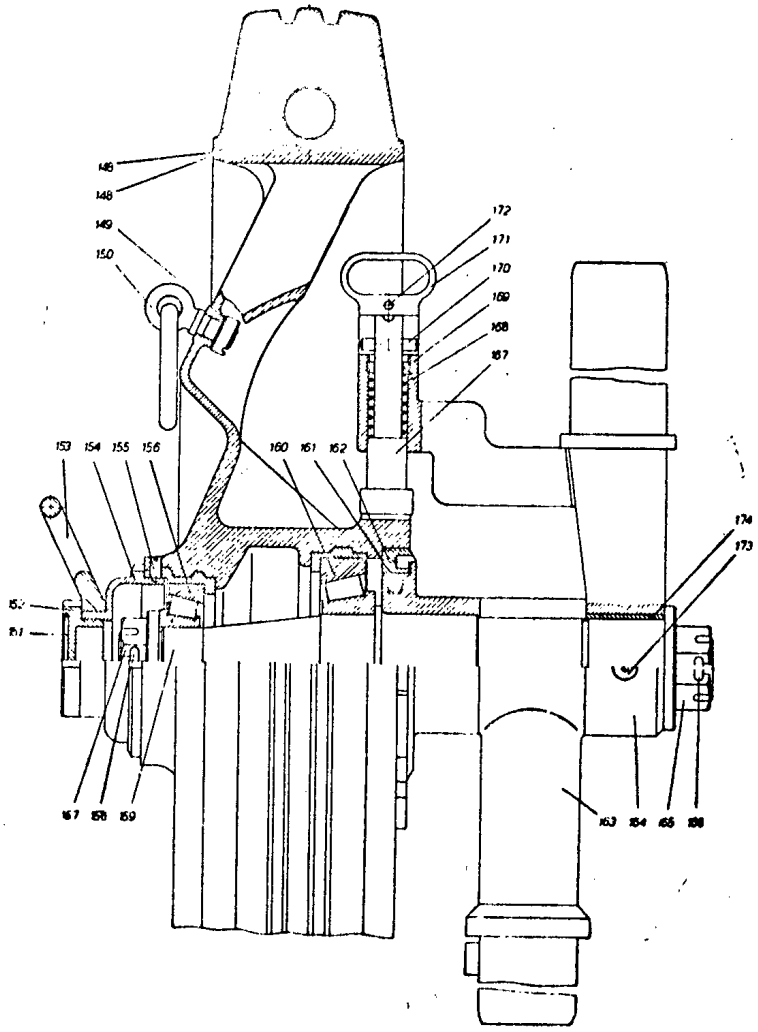


Fig. 26 — Wheel Assembly

148a— Wheel body — right
149b— Wheel body — left
149 — Loading ring nut
150 — Loading ring nut
151 — Wire lock
152 — Hub cover nut
153 — Ring for the rope
154 — Hub cover
155 — Hub screw
156 — Roller bearing — small
157 — Axle nut
158 — Cotter pin
159 — Axle
160 — Roller bearing — big
161 — Felt jointing
162 — Hub ring
163 — Wheel bracket
164 — Bipod bracket
165 — Nut
166 — Cotter pin
167 — Wheel lock bolt spring
169 — Nut
170 — Pin
171 — Hand grip
172 — Pin
173 — Grease cup
174 — Bronze casing

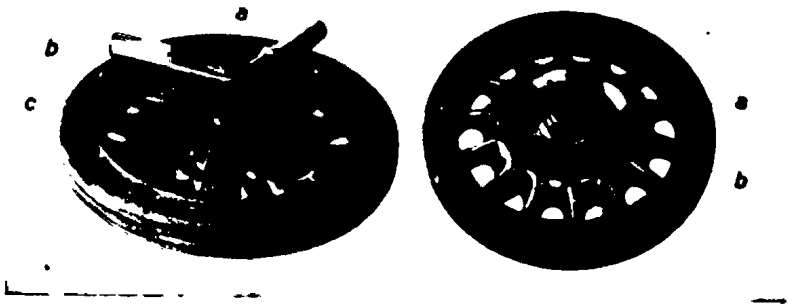


Fig. 27 — Wheel with brackets

a) Wheel bracket
b) Bipod support
c) Wheel lock

Fig. 28 — Wheel — External view

a) Loading ring
b) Rope ring

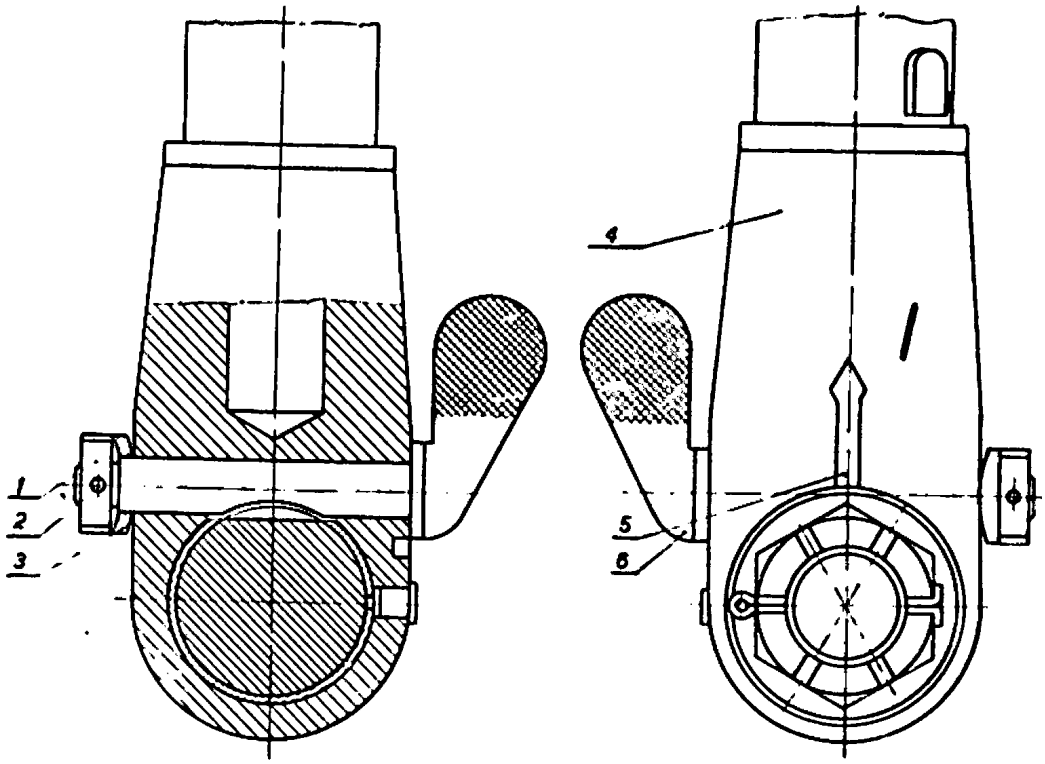


Fig. 28b — Stop bolt on the bipod bracket

1 — Nut
2 — Pin
3 — Blastic washer
4 — Bipod bracket
5 — Indicator
6 — Stop bolt

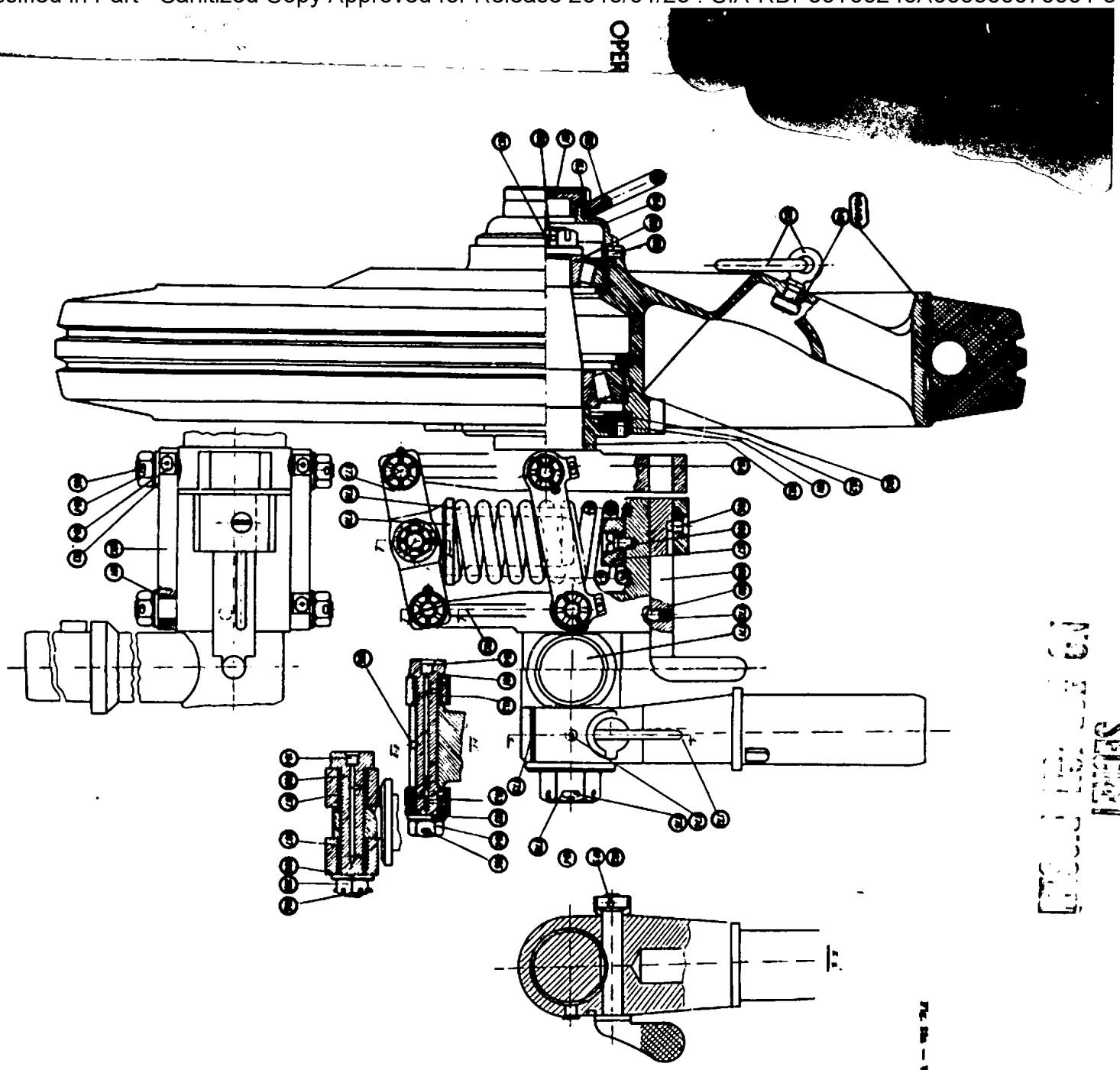


Fig. 8b — Wheel with suspension for motor towing

148 — Wheel, right.
148a — Wheel, left
149 — Nut
150 — Locking loop
151 — Wire lock
152 — Hub cover nut
153 — Ring for the rope
154 — Hub cover
155 — Hub screw
156 — Roller bearing, small
157 — Axle unit
158 — Cotter pins
159 — Lubricator
160 — Roller bearing, big
161 — Felt jointing
162 — Hub ring
163 — Felt jointing, retaining ring
164 — Semicircle bracket
165 — Stop screw
166 — Rubber buffer fixing screw
167 — Rubber buffer
168 — Wheel blocking key
169 — Locking pin
170 — Locking pin, spring
171 — Base plate bracket
172 — Stipod bracket
173 — Bronze bushing
174 — Lubricator
175 — Nut
176 — Cotter pin
177 — Suspension spring holder
178 — Spring guide
179 — Suspension bracket
180 — Suspension shaft
181 — Steel bushing
182 — Washer
183 — Lubricator
184 — Cotter pin
185 — Axle bolt
186 — Steel bushing
187 — Washer
188 — Nut
189 — Shackle link
190 — Steel bushing
191 — Nut
192 — Locking pin
193 — Elastic washer
194 — Suspension lock bolt
195 — Locking screw

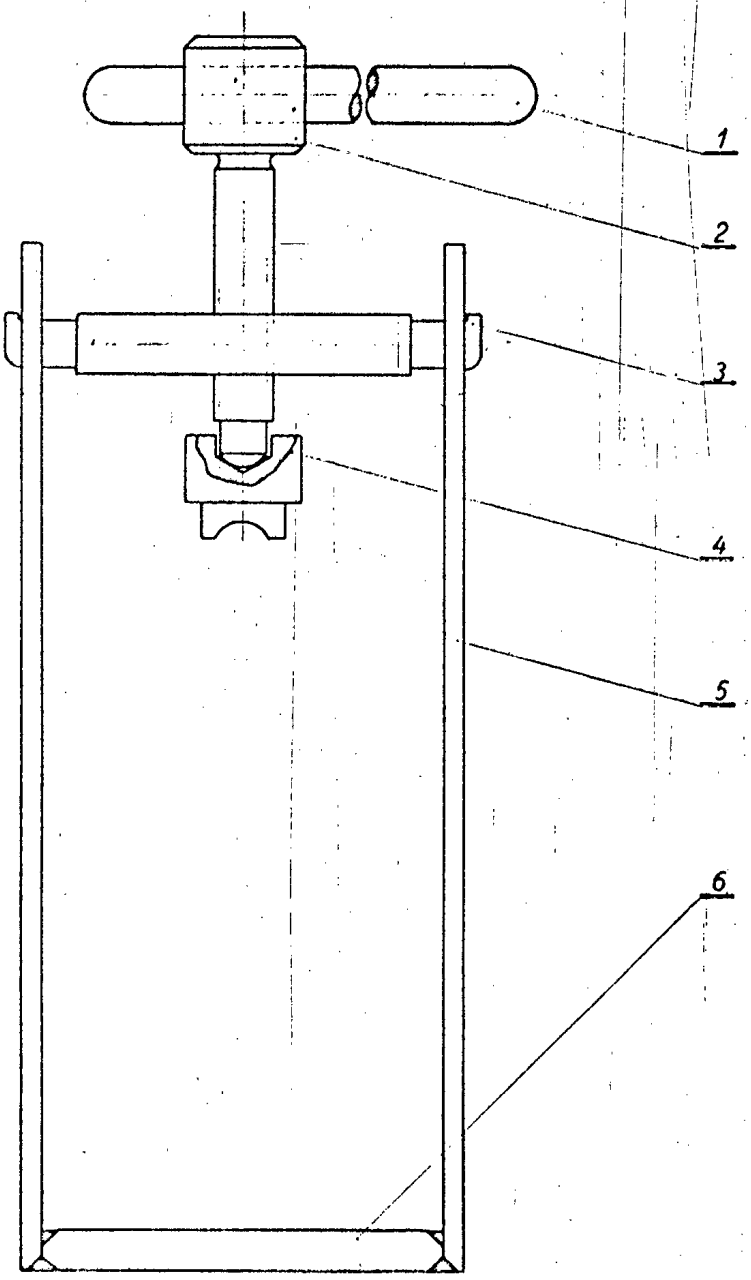


Fig. 28c — Suspension disassembling fixture

1 — Hand-grip
2 — Screw
3 — Cross-beam with nut
4 — Pusher
5 — Frame sides
6 — Frame base

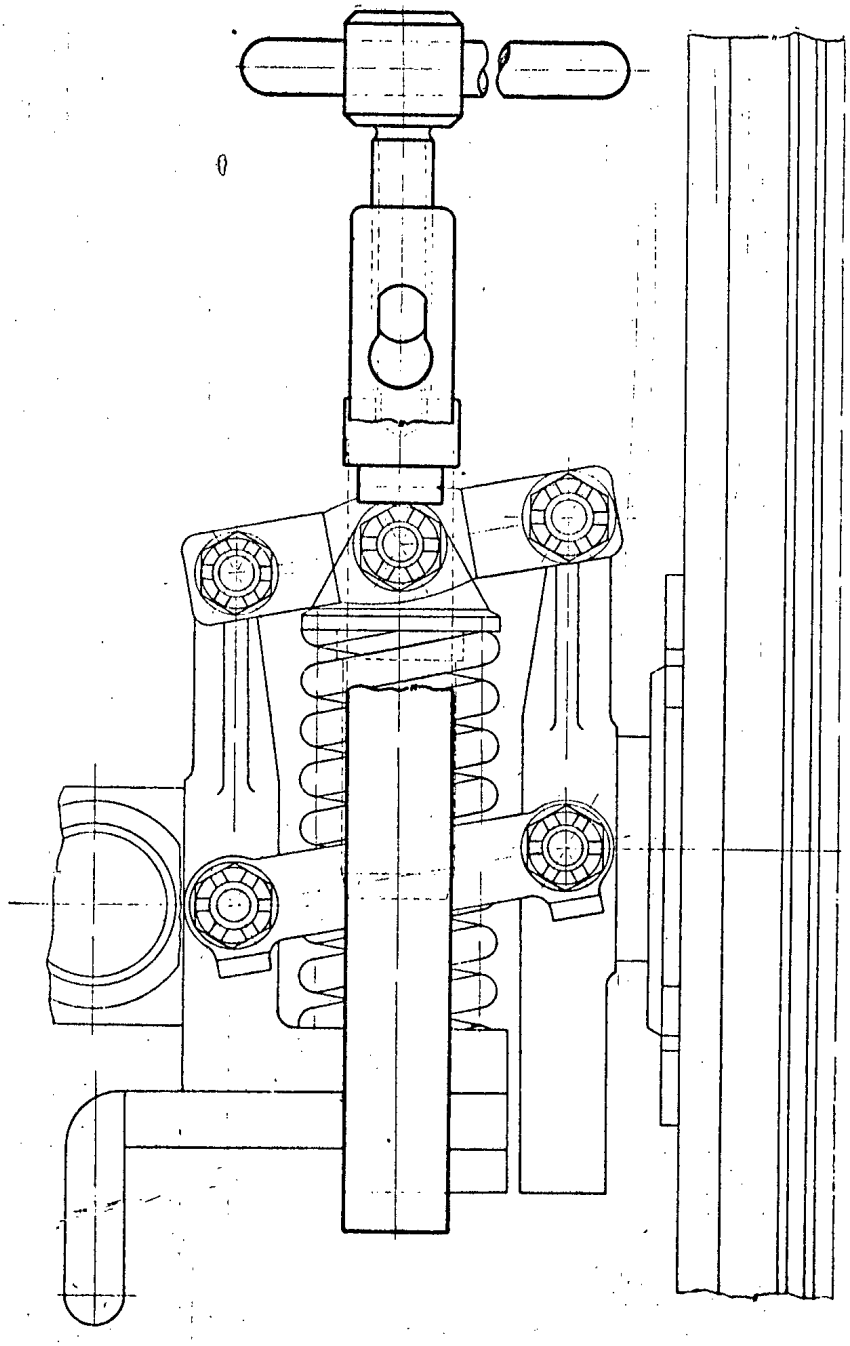


Fig. 28d — Use of suspension disassembling fixture

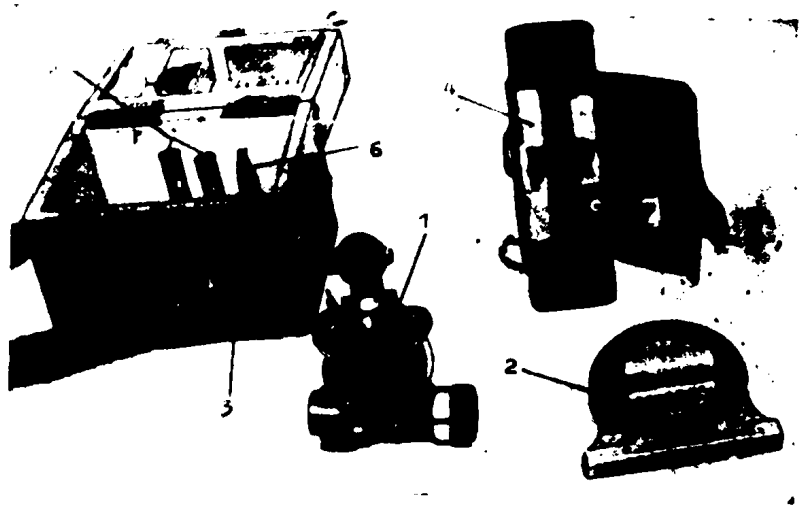
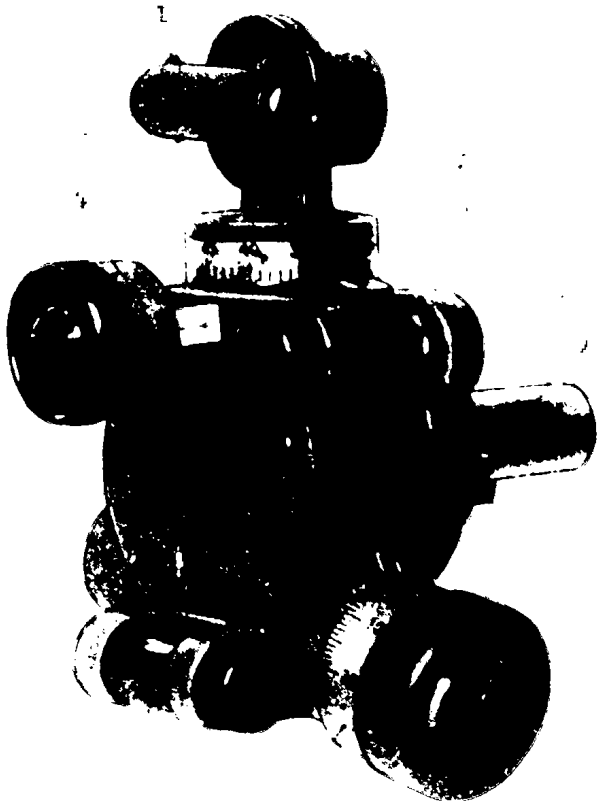


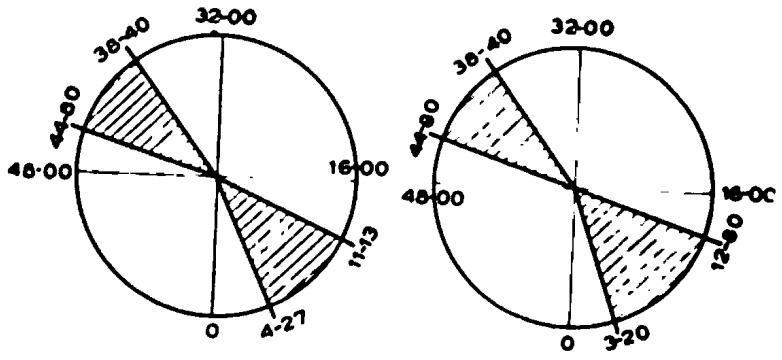
Fig. 29 — Sighting equipment of the mortar

1. Sight NSB-1
2. Gunner's quadrant M1
3. Case, sighting device
4. Case, gunner's quadrant
5. Levels for the sight
6. Screw-driver
7. Level, gunner's quadrant



1. Open sight, collimator
2. Collimator
3. Head, azimuth scale
4. Micrometer, azimuth scale
5. Azimuth scale
6. Cross level
7. Body axis
8. Longitudinal level
9. Elevation scale

Fig. 30 — Sight NSB-1 — view



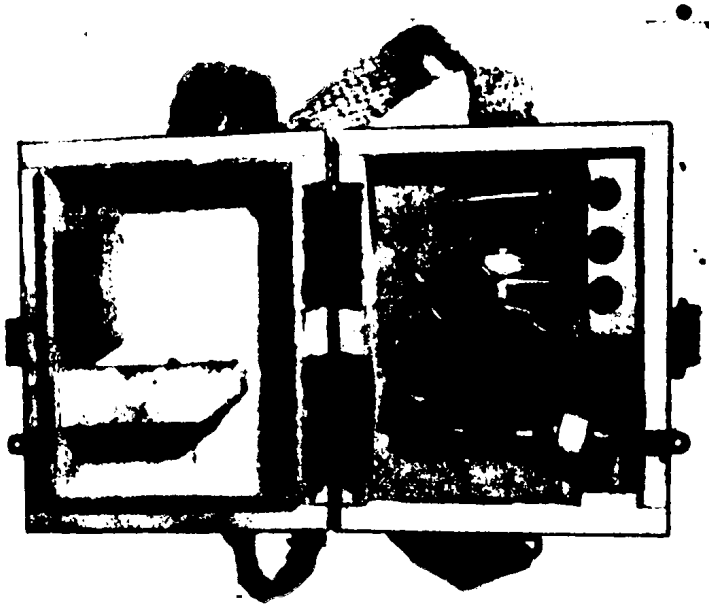


Fig. 31 — Sighting device NSI -1 packed in the box

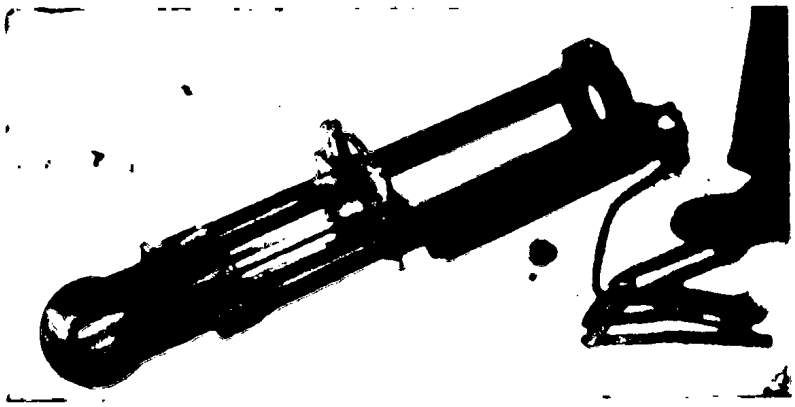
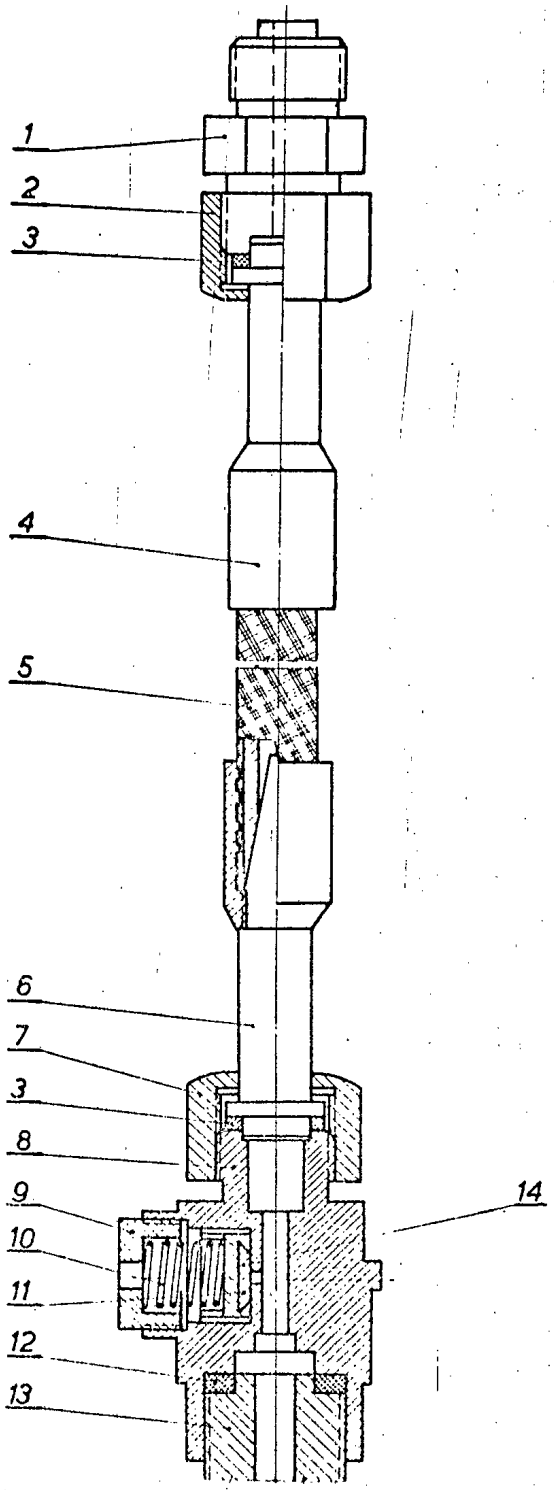


Fig. 32 — Filling air into the recuperator



1 — Reduction valve for nitrogen bottle
2 — Nut
3 — Seal
4 — Tube
5 — Armored hose
6 — Tube
7 — Nut
8 — Relief valve body
9 — Adjusting nut of relief valve
10 — Valve spring
11 — Valve plunger
12 — Fibre jointing (on the extension of recuperator cylinder)
13 — Recuperator cylinder extension
14 — Seal

Fig. 32a — Armored hose with relief and reduction valve for filling of the recuperator with nitrogen

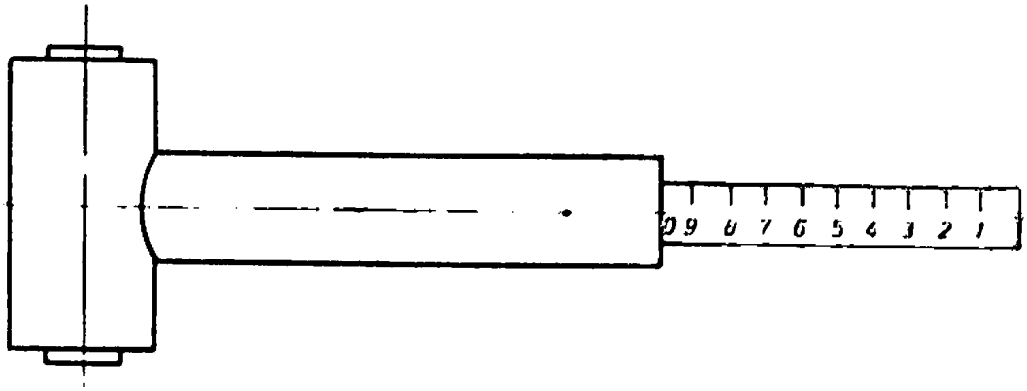


Fig. 32b -- Gauge for measuring pressure in the recuperator

Fig. 33 — Indexe on the hydraulic recoil brake nut

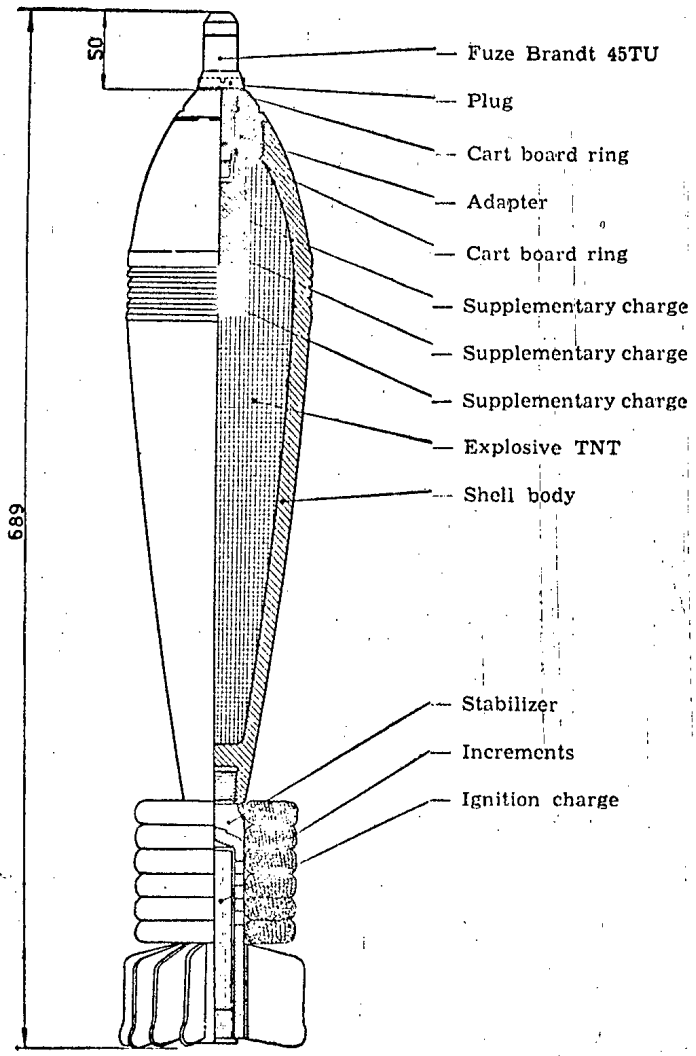


Fig. 34 — High explosive Mortar shell M 49 (heavy)

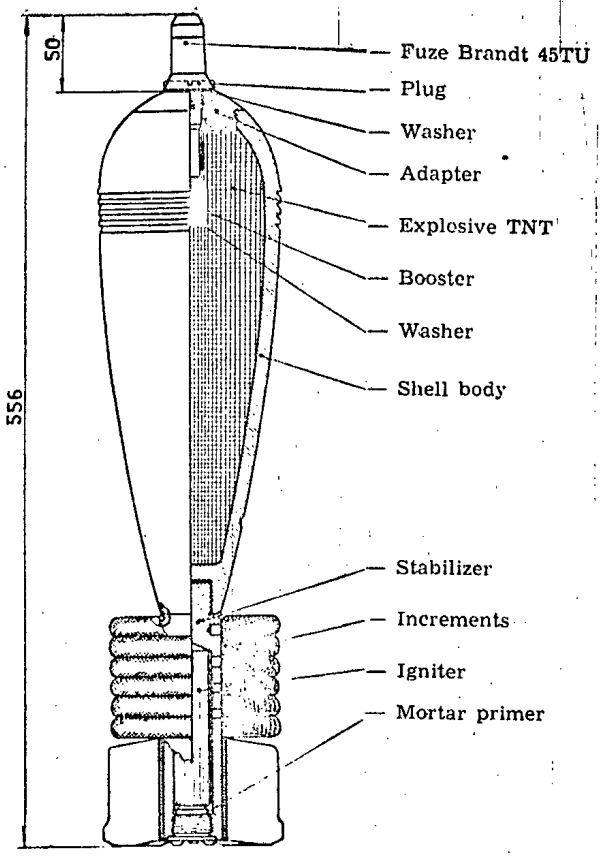


Fig. 35 — High explosive Mortar shel M 56 (light)

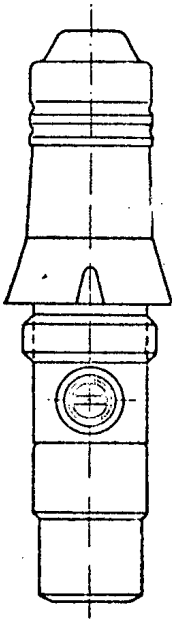


Fig. 38 — Fuze »Brandt 45TU« general view

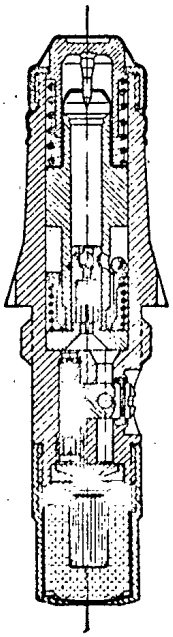


Fig. 39 — Position of fuze parts on climbing trajectory

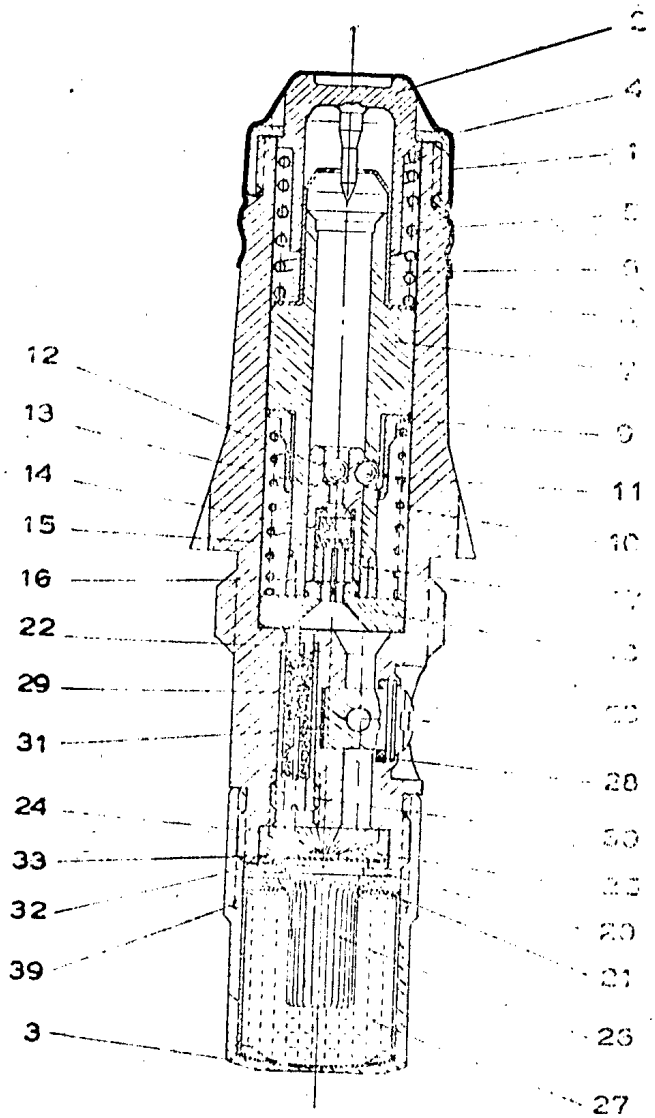


Fig. 37 Fuze »Brandt — 15-TU«

1 — Fuze cap
2 — Needle
3 — Booster jacket
4 — Striker mechanism fastener
5 — Striker spring
6 — Primer cap support stop
7 — Primer cap support guide
8 — Fuze body
9 — Arming ring
10 — Spring
11 — Safety pellet
12 — Protecting cap
13 — Primer cap support
14 — Primer cap
15 — Primer cap base
16 — Ring retainer
17 — Primer cap fastener
18 — Striking mechanism support
20 — Steel ring
21 — Washer
22 — Flash diffuser
23 — Regulator
24 — Flash booster
25 — Flash booster support
26 — Detonating cap
27 — Booster charge
28 — Sealing ring
29 — Retarder
30 — Retarder body
31 — Regulator base
32 — Lead ring
39 — Screw ring

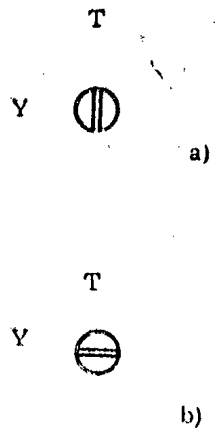


Fig. 40 — Fuze regulator

a) T — superquick action
b) Y — delayed action

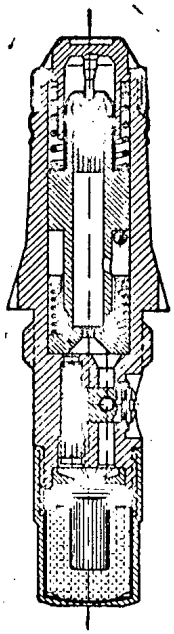


Fig. 41 — Position of fuze parts on descending trajetory

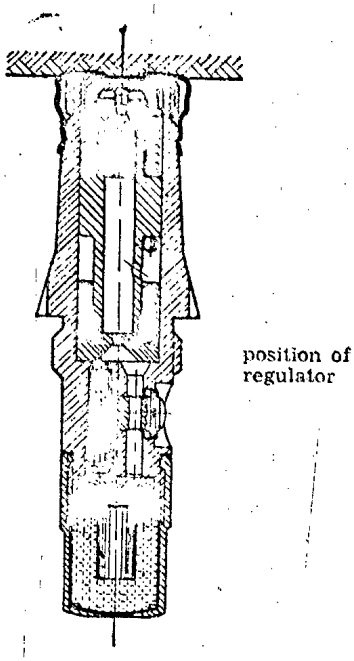


Fig. 42 — Position of fuze parts at superquick action

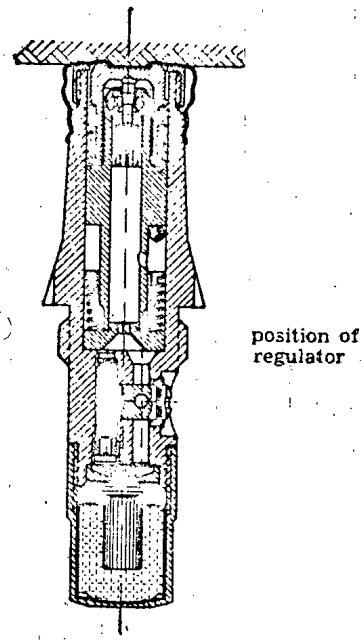


Fig. 43 — Position of fuze parts at delayed action

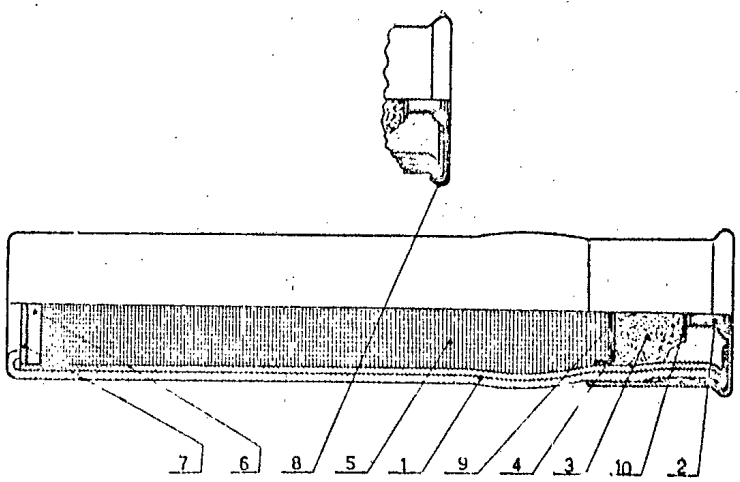


Fig. 43a — Ignition charge for HE Mortar shel M 49 (heavy)

1 — Case
2 — Ignition primer
3 — Black powder pellet
4 — Membrane
5 — Powder
6 — Plug
7 — Cover
8 — Base of case
9 — Folio
10 — Folio

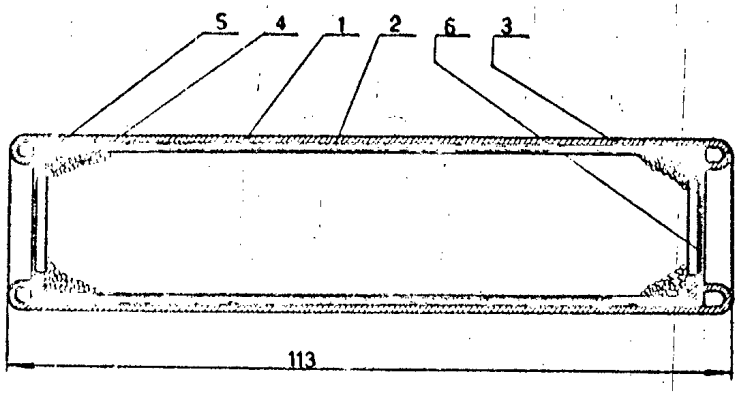
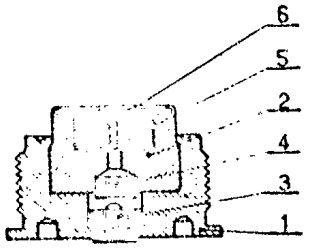


Fig. 43b — Igniter for HE Mortar shell M 56 (light)

1 — Case outer
2 — Case inner
3 — Cover
4 — Powder
5 — Cart board ring
6 — Label



6 — Celluloid cover
5 — Black powder pellet
2 — Holder
4 — Primer M 35
3 — Striking roller
1 — Primer body

Fig. 43c — Mortar primer M 57 for shell M 56

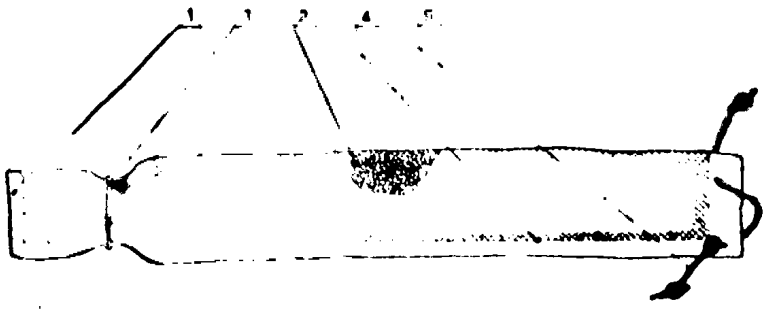


Fig. 44 — Increment for HE Mortar shell M 49 (heavy) and M 56 (light)

1 Bag
2 Powder
3 Cord
4 Thread
5 Cord

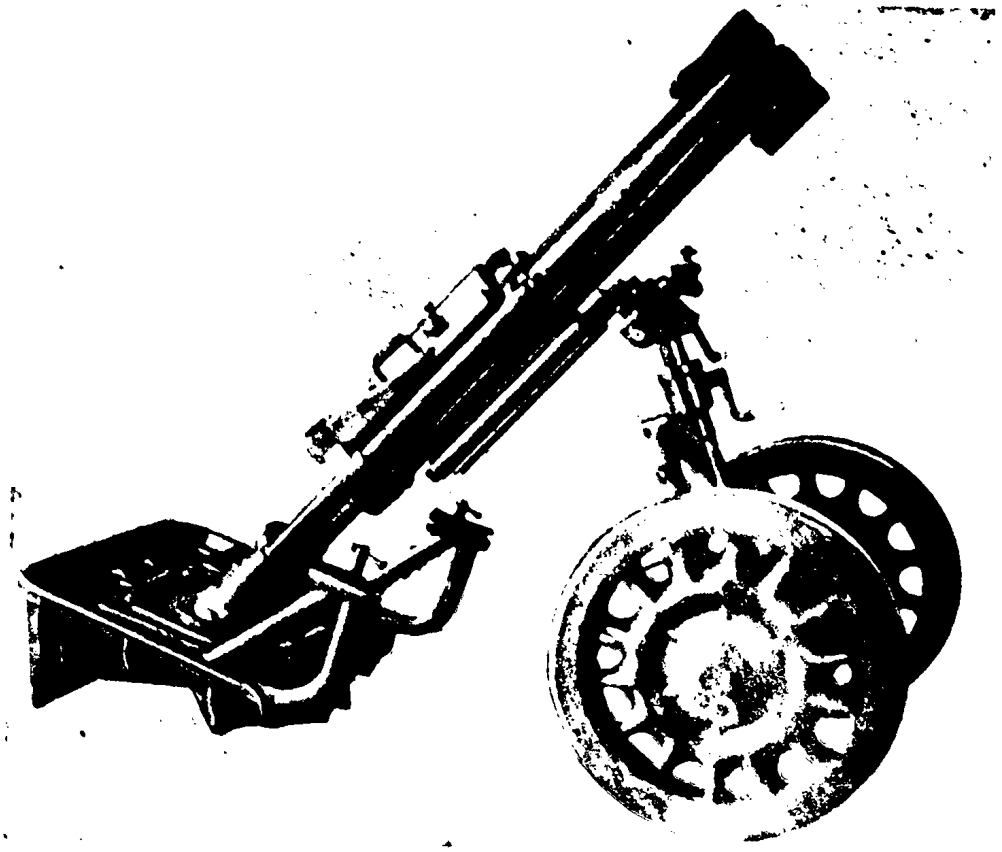


Fig. 45 — [illegible]

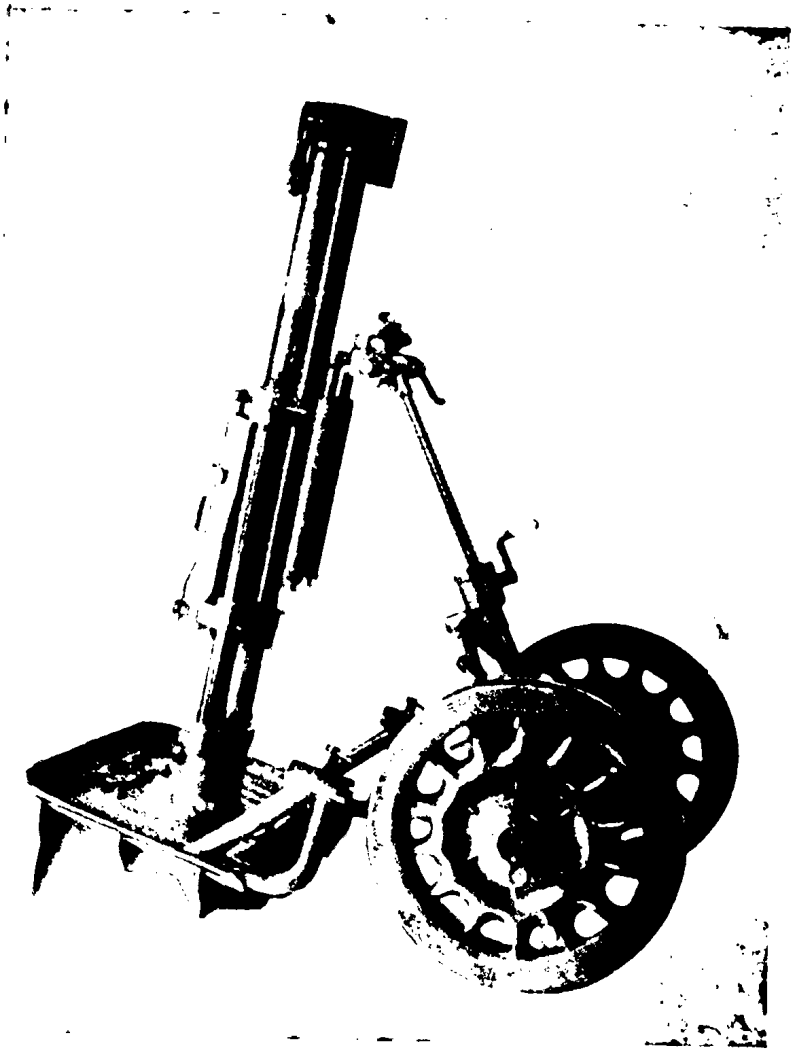


Fig. 13 — Normal position of the Mortar for firing at an elevation of 80

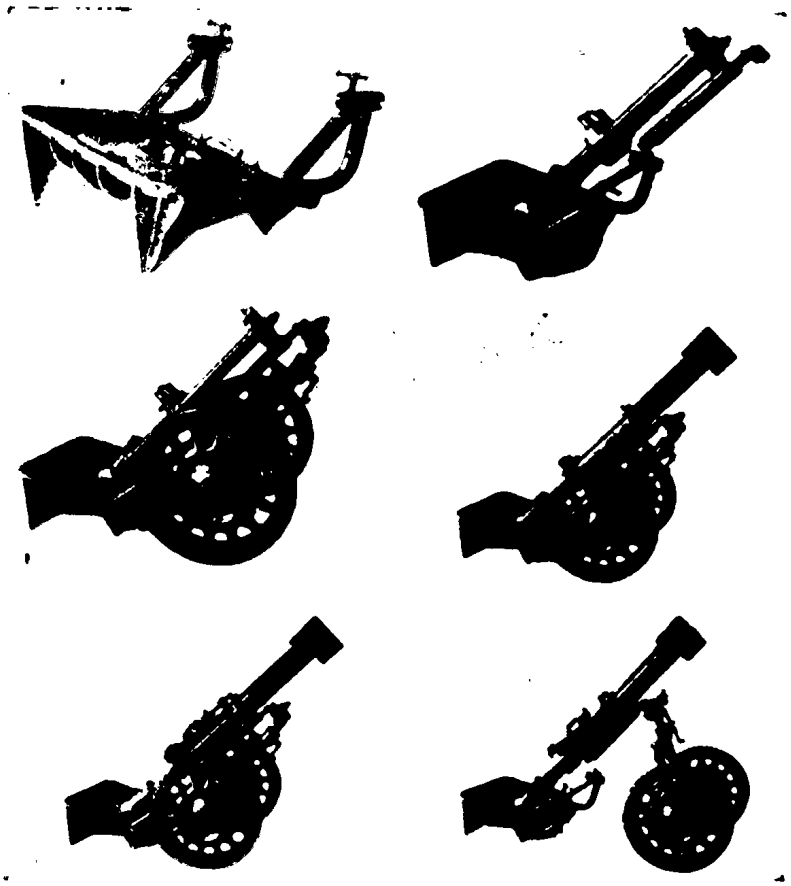


Fig. 46 - - Working procedure during assembling of Mortars

Fig. 47 Blocking of wheels on mortar without suppension

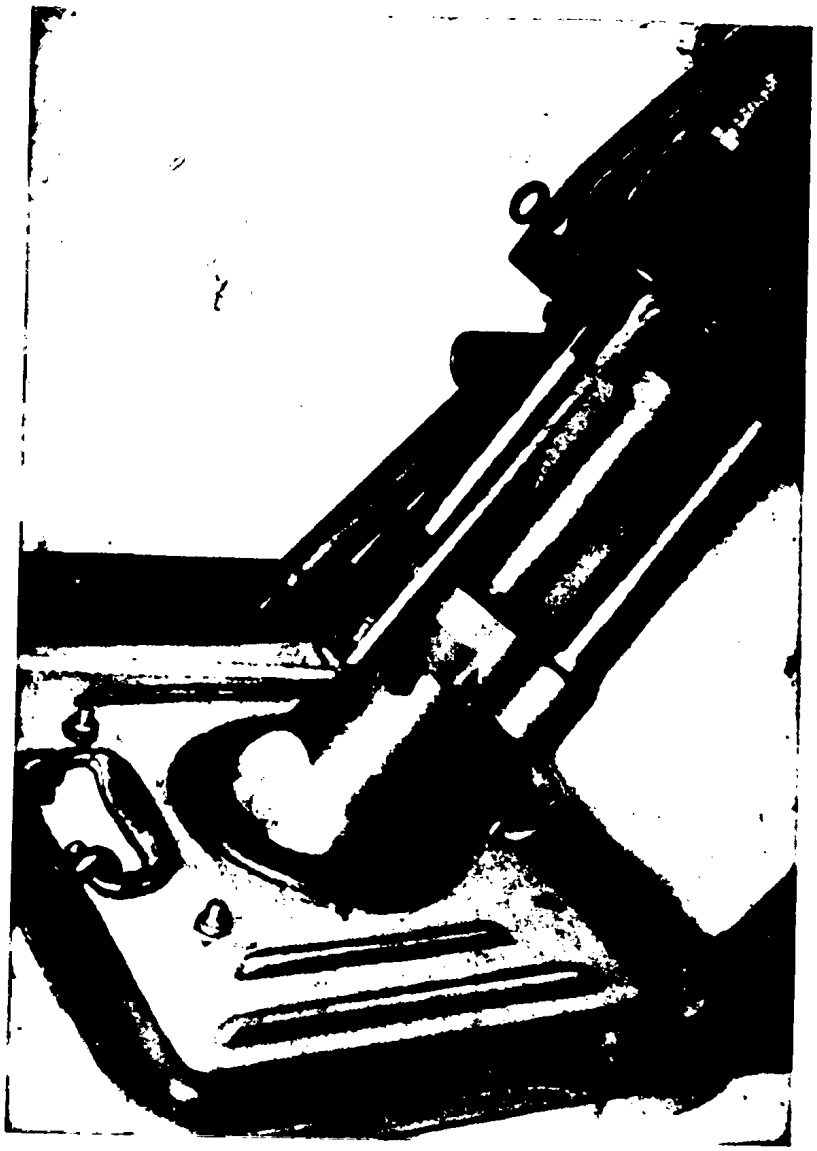


Fig. 48 — Firing the weapon with lanyard

[illegible] without liquid in recoil brake

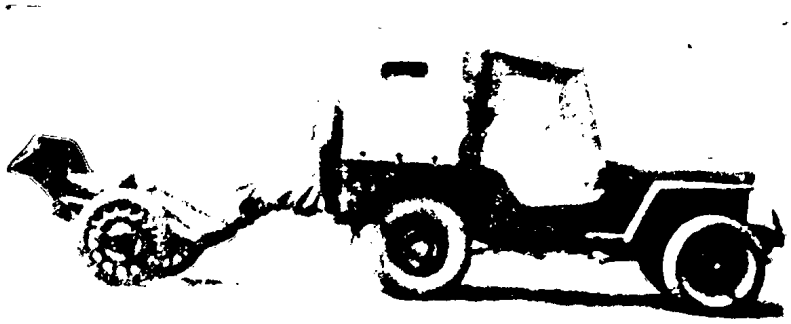


Fig. 31 — Mortar in trail

Fig. 32 — Mortar in tandem tow

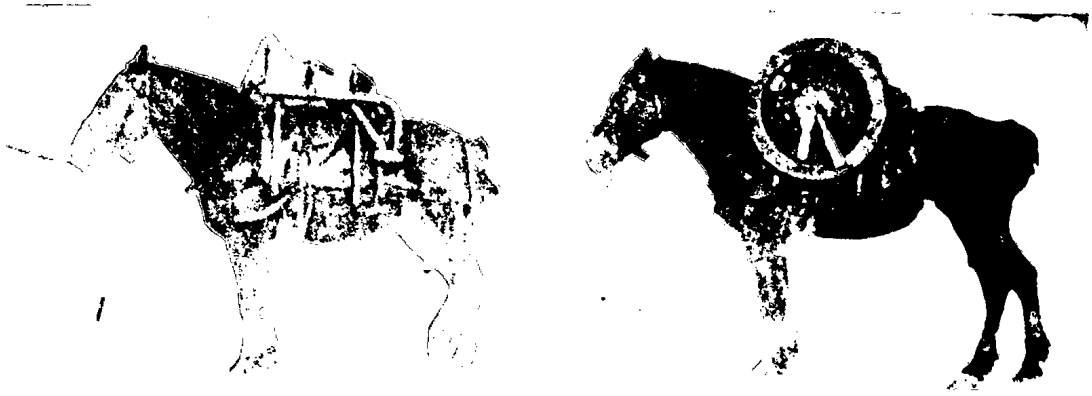
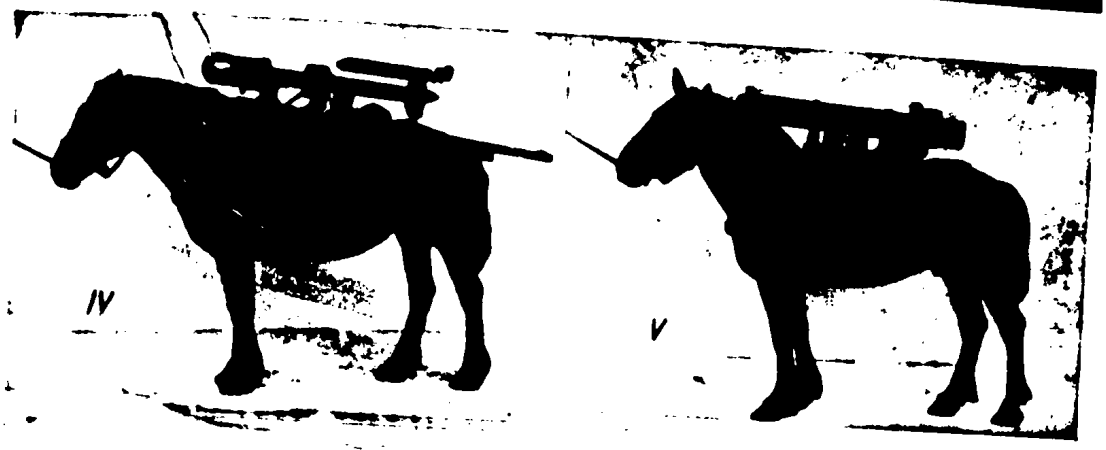
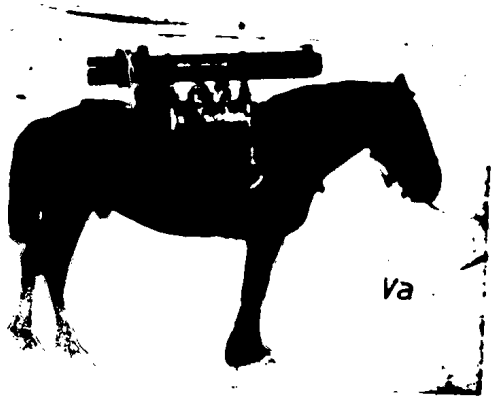


Fig. 33 — [illegible]

I — [illegible]
II — [illegible]





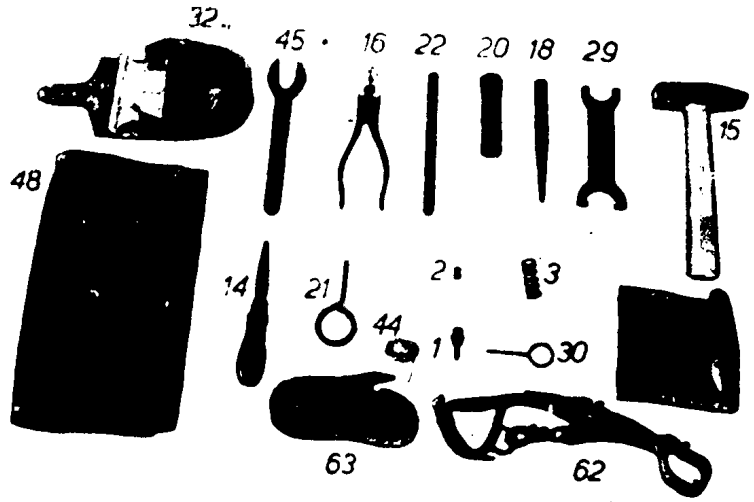


Fig. 60 — Weapon set parts

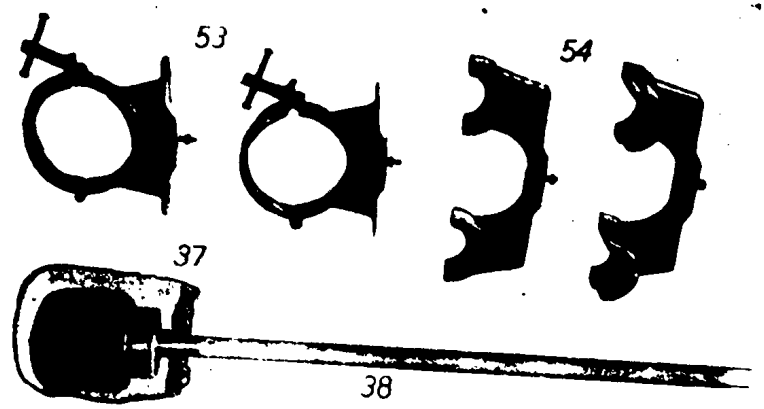


Fig. 61 — Pack-[illegible] and barrel cleaner

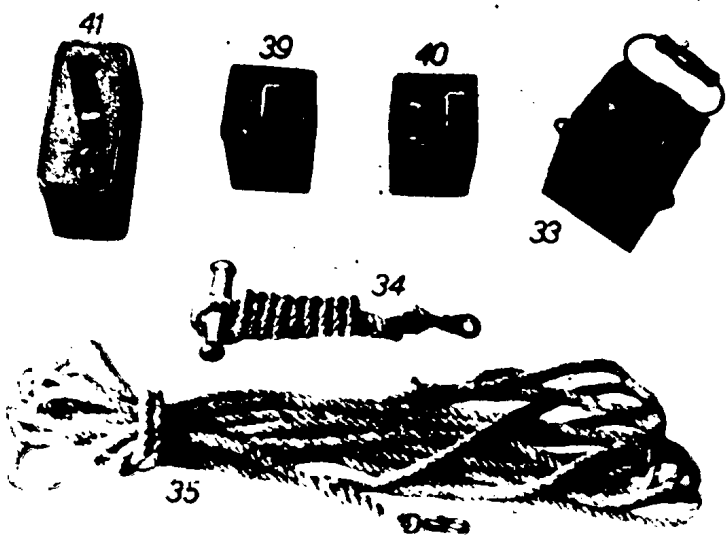


Fig. 62 — Oil can, lantern, short and long lanyard

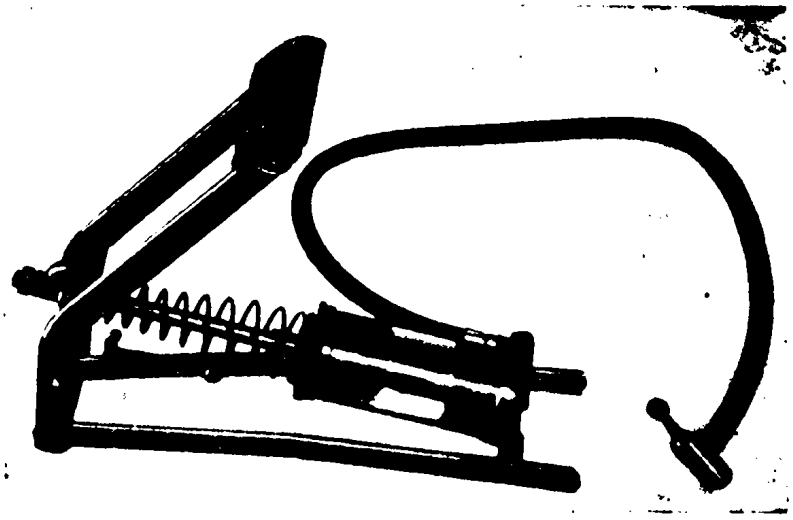


Fig. 69 — Recuperator air pump — **pumping** position

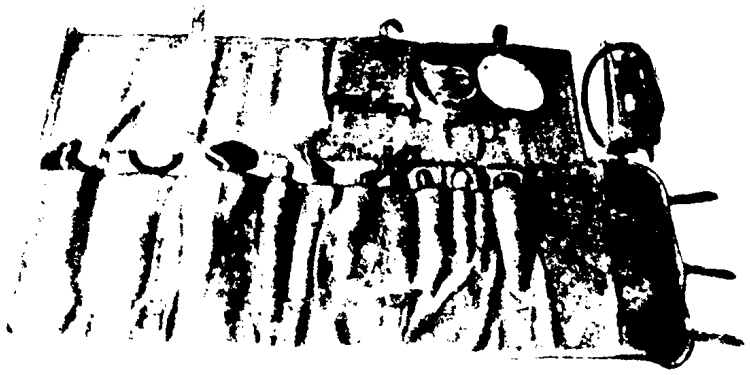


Fig. 70 — Battery [illegible] — in wrapper

Fig. 71 — Battery [illegible] packed

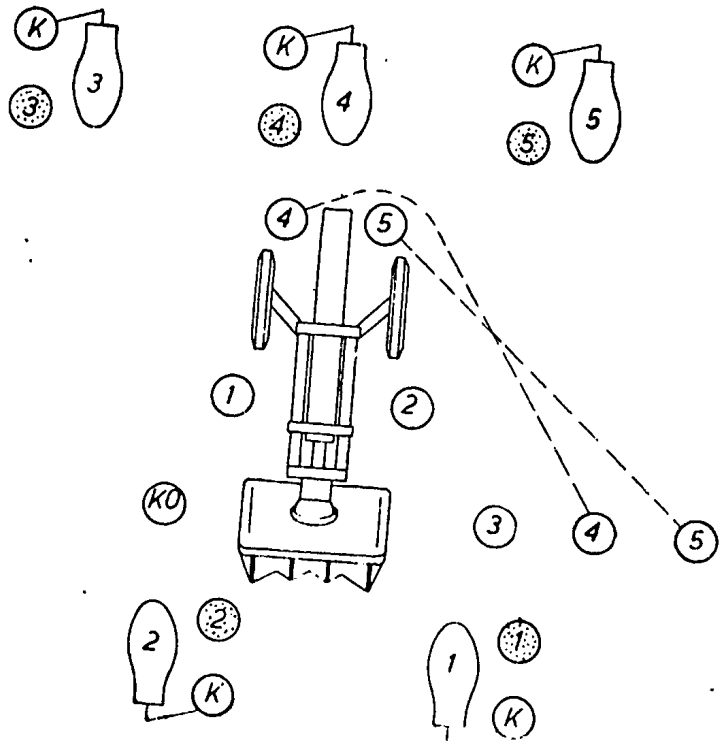


Fig. 72 — Diagram of the crew in firing position, during diassembling and after loading on pack-animals

Note: KO = squad commander
K = horse leader

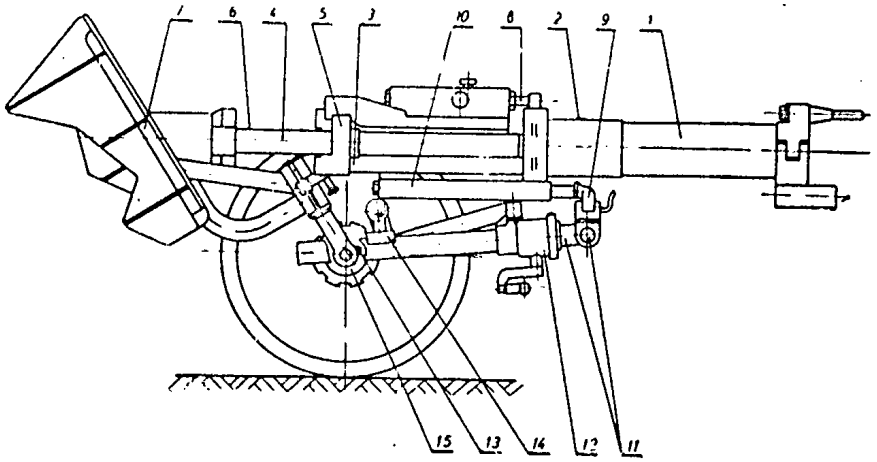


Fig. 73 — Lubrication guide