Small Arms Training
Volume I, Pamphlet No. 19

Anti-Tank Gun
(25-mm. Hotchkiss, Mark I on 25-mm. Carriage, Mark 7)

1939
Small Arms Training

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Anti-Tank Gun
(25-mm. Hotchkiss, Mark I on 25-mm. Carriage, Mark I)

1939

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29th November, 1939.
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SECTION 1—GENERAL

1. Publications dealing with the weapon
   i. This pamphlet gives the essential information for training anti-tank gunners.
   ii. The handbook for the Gun, 25-mm. Hotchkiss, Mark I, gives the technical details.
   iii. A guide to concealment and camouflage of the weapon can be found in Notes on Concealment and Camouflage, Military Training Pamphlet No. 26.

2. Designation of the weapon
   The equipment is known as the 25-mm. Hotchkiss, Mark I on Carriage, 25-mm. Mark I.
   The equipment consists of two main components, the gun and the carriage.
   25-mm. (‘98 in.) is the calibre of the gun.

3. Characteristics of the weapon
   i. It fires a solid bullet at a high muzzle velocity (3,020 feet per second), which is capable of penetrating armour plate at long ranges.
   ii. This high muzzle velocity results in a flat trajectory and a short time of flight.
   iii. There are two types of bullet, both armour piercing. One is fitted with a tracer plug, the other is not.
   iv. The mechanism of the breech is semi-automatic, which allows of quick loading and assists in keeping up a high rate of fire.
   v. The equipment is very steady in action for the following reasons:
      (a) It is fired from a four point support.
      (b) It has a low centre of gravity.
      (c) It has an efficient recoil and recuperator system.
      (d) It has long legs.
      (e) The equipment is heavy, the actual weight being about 10 cwt.
   vi. The equipment is of simple design and is easy to manipulate and a well-trained team can therefore bring the gun into action in a very short time.
   vii. When in action the carriage allows of a total traverse of 60°, 30° on each side of a central line. The gun has a vertical movement of 20°, 15° elevation and 5° depression.

2—(5579)
viii. It is fitted with two sights, the telescopic sight and the emergency open sight.

ix. The gun is normally carried on a 15 cwt. truck. It can also be towed by this vehicle and has rubber-tyred wheels to reduce vibration. When on tow the speed should not exceed 20 m.p.h. on good surfaces, or 10 m.p.h. on bad surfaces.

4. A suggested syllabus of training is at Appendix "A."

SAFETY

Whenever any instruction in the equipment is being given and cartridges are being used, care will be taken to ensure that these are drill cartridges.

SECTION 2—ORGANIZATION

1. The anti-tank company consists of a headquarters and three platoons. Each platoon, which is self-contained administratively, is commanded by a subaltern and contains three 25-mm. A.Tk. guns.

2. Each gun detachment consists of a corporal, three gun numbers and a driver for the 15-cwt. truck in which the gun, detachment and ammunition are carried.

3. All other ranks are armed with rifles.
SECTION 3—GENERAL DESCRIPTION—CARRIAGE, 25-mm. MARK I

1. General

The carriage is of the split trail type, and allows of traversing only when the legs are fully splayed apart.

No travelling brake is provided, but a small brake, for use when firing, is fitted to each wheel.

The carriage consists of the following principal parts:—

2. Trail

The trail consists of two legs, each is of box section, hinged together at the forward end.

The left leg is fitted at the front end with a bracket which hinges about the centre pivot. A projecting arm carries a shock absorber which engages on a bearing face on the axle when the legs are closed. When the legs are splayed apart the shock absorber is disengaged and this allows the axle to articulate.

A small projection on top of the hinge bracket serves as a traverse limiting stop which engages the traverse stop when the latter stop is released.

A ring bolt is fitted near the front end for towing or slinging purposes.

The rear end is fitted with a folding spade which can be raised or lowered and can be locked in either position by means of a locking lever.

A lifting handle is provided to which is fitted a ring to receive a hauling bar. There is also a trail locking bolt bracket and a clip bracket for securing the locking levers of the spade when the trail legs are closed.

Towards the rear, on the inside, the leg is fitted with two brackets to carry the towing bar.

Towards the front, there is a bracket to hold the end of the cross-stay when the legs are fully splayed.

The right leg is similar to the left leg without the housing brackets for the towing bar.

On top, near the front, there are brackets to hold the spanner for use on the flash eliminator.

A bracket, to which is pivoted the cross-stay, is fitted near the front end and a second bracket to house it when not in use is behind the first one.

At the rear end is an eye to attach the trail to the vehicle for towing.
3. Axle tree

The axle tree consists of a bar at the centre of which is a bracket on which forms the centre pivot. The arrangement of this allows for a difference in level of the wheels of about two inches.

Each end is fitted with a tapered axle arm and inner hub caps.

A wheel brake is provided in each hub cap for use when firing.

Two metal faces are provided to receive the shock absorber plungers on the legs when in the travelling position.

4. Wheels

The wheels are of the disc type. The tyres are filled with a rubber core to make them puncture proof.

The hub is closed by a hub cap, which can be removed for greasing purposes.

5. Centre pivot

The centre pivot serves as a hinge bolt for the front ends of the trail legs and is secured in the trail leg hinge brackets by a large flanged nut on its lower end.

The upper end has an external flange on which worm teeth are cut to serve as a traversing rack.

Inside it carries the pivot pin of the carriage body.

6. Cross stay

This consists of a screw-threaded bolt which has one end forked to receive a pivot pin by which it is hinged to the right leg.

Engaging the screw threads is an elongated nut which forms a finger grip.

By turning the nut it can be withdrawn from its housing and pivoted about its pivot pin, and when the legs are fully splayed can be turned into its housing bracket to keep the legs in that position.

7. Carriage body

This consists of a bottom plate and two sides formed in one.

The bottom plate is provided on the underside with a pintle which is in the centre pivot and forms the axis round which the carriage body revolves.

At the top of each side is a bushed trunnion bearing to receive the cradle trunnions. Cap squares keep the trunnions in position.

At the bottom of each side there are clips which interlock with corresponding clips on the trail leg hinge brackets when
the legs are closed, thus preventing damage to the traversing gear.

An elevating arc is welded on an extension of the left side. The traversing gear is carried in cases in the rear and left side of the carriage body.

8. Cradle

This is trough-shaped and has a lug in front to carry the gun stay (front elevating lock) for use when travelling.

The front band is fitted with a guide bush for the gun, the bush being fitted with a felt packing ring and lubricator.

Each side has guide ways in which the gun slides move during recoil and run-out.

Trunnions are fitted on each side which support the cradle on the carriage body.

The transom has an upper opening for the buffer piston rod and a lower opening for the attachment of the compressing rods on the recuperator gear (run-out press).

The elevating gear worm case and firing gear are carried at the left rear.

A flange to carry the telescope holder and bosses to take the gunlayer’s guard are also provided on the left side.

9. Gunlayer’s guard

The gunlayer’s guard is provided to ensure that the layer is protected from the recoiling parts of the gun, and is supported in the bosses of the cradle. It is secured by a plunger.

10. Traversing gear and elevating gear

These are of the worm and worm wheel type. They are self-locking. A further explanation of them is given in “Mechanism” (Sec. 6, Lesson 18).

11. Firing gear

This is mounted on the left rear of the cradle and consists of various rods and links. A further explanation is given in “Mechanism” (Sec. 6, Lesson 17).

12. Shield

The shield is in two parts, an inner and an outer.

The inner shield consists of a bent steel plate and is secured to the front of the carriage body. It has a central elongated opening to receive the gun and cradle and to allow for elevating and depressing. An opening on the left side is provided for the sight carrier.

Bolted to the inner shield and to the cradle is a sight port mantlet with a slot which can be closed or opened according as to whether the open sight is in use or not.
A bracket is provided to carry the flash eliminator when not in use.

The outer shield is U-shaped and is supported by two stays fixed to the axletree. It forms two side wings for the inner shield.

13. Gun stay

The gun stay is formed with forked ends, one of which is hinged to the bracket on the lower shield plate. The other end carries a locking pin for attachment to the lug on the front of the cradle.

It secures the gun to the cradle to prevent damage to the elevating gear when travelling.

14. Telescope holder

This holder is tubular in section and is supported on an axle bracket and is carried on the left side of the cradle.

The rear end is supported on a pivot screw and the front end can be given vertical movement for adjusting purposes by an adjusting screw.

The supporting bracket pivots about a screw near its front end and can be given lateral movement for adjustment by an adjusting screw.

**MISCELLANEOUS DATA**

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<td>Firing position</td>
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<td>Total weight—gun and carriage complete</td>
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SECTION 4—ANTI-TANK GUN DRILL

General

1. The seating positions in the truck are:—
   - Gun detachment commander in front by the driver.
   - No. 1 (the layer) Rear off corner.
   - No. 2 (the loader) Rear near corner.
   - No. 3 Front near corner.

2. All numbers should be trained in each others duties, and the driver should be trained as a gun number.

3. The gun will normally be carried on the truck. At some selected place behind the action position the gun may have to be taken off the truck and put on tow.

4. It may be possible on occasions to take the truck up to the action position in which case the sequence laid down in Lessons 1, 3 and 4 can be carried out consecutively.

5. Although each number’s duties are detailed separately in the following paragraphs, it must be understood that all numbers work simultaneously.

6. Stores:—
   Complete equipment with towing vehicle, drill cartridges and containers.
   When no vehicle is available, the detachment will fall-in a few paces in rear of the gun. They will take up positions on the ground corresponding to their positions on the truck. The trail will be rested on a platform.

Lesson 1—To prepare for towing

The G.D.C. orders ‘‘ Prepare for towing.’’
The driver lowers the tailboard.

The G.D.C. and No. 1 remove the ditching boards from near side and off side respectively and place them in position. The G.D.C. must see that they are correctly aligned. He and No. 1 stand by the gun trail.

Meanwhile No. 2 moves to the off-front side of the gun. No. 3 releases the trail stay. No. 2 orders ‘‘ Lift ’’ and G.D.C. and No. 1 lift on the trail, allowing No. 2 to release the truck stay, he then orders ‘‘ Lower.’’
No. 1 puts the towing bar in position.
Nos. 2 and 3 take up a position by the wheels.
G.D.C. orders "Ready" and the gun is then run down the ramps and ditching boards, G.D.C. and No. 1 controlling the movement of the trail.
Nos. 2 and 3 replace the ditching boards on the truck. The driver raises and fixes the tailboard.
The truck can now be turned and brought up to the trail of the gun, or the detachment can turn the gun till the trail faces the rear of the truck.
The gun is then hooked to the truck.

Lesson 2—To put the gun on truck

To get the gun from tow to truck the duties detailed above are reversed, with the exception that, during the movement of the gun up the ditching boards, Nos. 2 and 3 assist the G.D.C. and No. 1 by pushing on the wheels; No. 2 on the near side wheel, No. 3 on the off side wheel.
When the gun is on the truck Nos. 2 and 3 jump on the truck and assist in getting the gun on the wheel blocks.

Lesson 3—To prepare for action

The G.D.C. orders the number of ammunition boxes and "Prepare for action."
The G.D.C., with the assistance of No. 3, removes one ammunition box from the vehicle and places it across the trail of the gun. He now stands by the left wheel facing the trail.

No. 1—Assists No. 2 to unhook the gun from the vehicle.
Removes the cover from the front of the telescope holder.
Releases the gun stay.
Inserts the towing bar through the towing eyes.
Removes the telescope and the spare parts wallet from the vehicle and takes up his position by the towing bar.

No. 2—Assists No. 1 to remove the gun from the vehicle.
Removes the breech cover.
Opens and inspects the breech (closing the breech after his inspection).
Removes the oil can wallet from the vehicle and takes up his position by the towing bar.
No. 3—Assists the G.D.C. to remove an ammunition box. Removes the muzzle cover and puts the flash eliminator on the barrel. Removes the cleaning rod wallet from the vehicle and takes up his position by the right wheel facing the trail.

Note.—If ten-round ammunition containers are in use the G.D.C. will remove one container before taking up his position by the left wheel, and No. 3 will remove one container when he gets the cleaning rod wallet from the truck.

Lesson 4—To come into action

The instructor orders "action (right, left, front, rear or some direction on the ground)."

G.D.C.—Repeats the order.
Controls the movement of the gun to its action position (during the last few yards full use should be made of the armoured shield by pushing instead of pulling the gun).
Takes up his action position.

No. 1—Assisted by No. 2, takes the weight on the towing bar or on the trail legs depending on the distance to be covered, and pulls the gun into the action position.
Removes and houses the towing bar.
Opens the trail legs to their fullest extent.
Lowers and locks the trail spade.
Applies the left wheel brake.
Releases the traversing lock.
Releases the rear elevating lock.
Levels the gun to "point blank."
Assembles and locks the telescope.
Adopts firing position, holding the traversing handle with the left hand and elevating wheel with the right hand.

No. 2—Assisted by No. 1, takes the weight on the towing bar or on the trail legs depending on distance to be covered, and pulls the gun into action position.
Releases the trail locking pin.
Opens the trail legs to their fullest extent.
Lowers and locks the trail spade.
Secures and tightens the cross stay.
Applies the right wheel brake.
Places an ammunition box in a convenient position. Removes one round and takes up a loading position.

No. 3—Places the ammunition box in a suitable position for No. 2.
Returns to the vehicle and with the driver's assistance brings up another ammunition box. He may now be required to assist No. 2 by handing him rounds ready for loading or may be used as a chain of supply from the vehicle to the gun.

Note.—If ten-round ammunition containers are in use the G.D.C. and No. 3 will place their containers in a suitable position for No. 2.

Lesson 5—Cease firing

G.D.C.—Orders "'Cease firing.'"
Takes up a position for towing.
Controls the towing of gun back to the vehicle position.
If the vehicle can approach the action position he will send the signal for vehicles.
Ensures that all ammunition is removed from the position.

No. 1—Removes the telescope and replaces its cover.
Disengages traversing lock.
Traverses the gun until locked in a central position.
Elevates the barrel to its highest position.
Applies the rear elevating lock.
Releases the left wheel brake.
Releases and rehouses the trail.
Closes the left trail leg.
Assembles the towing bar and takes up his position for towing.

No. 2—Replaces any ammunition in the boxes (or containers, if in use).
Releases the right wheel brake.
Releases and houses the cross stay.
Releases and rehouses the trail spade.
Closes the right trail leg.
Relocks the trail locking pin and takes up his position for towing.

No. 3—Ensures that no ammunition (or containers) are left on the position.
Takes up his position for towing.
Lesson 6—Limber up

G.D.C.—Orders "Limber up."
Inspects the gun to ensure that it is fit for travelling.
Assisted by No. 3 puts any ammunition boxes on the vehicle.

No. 1—Assists No. 2 to attach the trail eye to the vehicle.
Rehouses the towing bar.
Releases the rear elevating lock.
Applies the gun stay and rear elevating locks.
Places the spare parts wallet and telescope on the vehicle.

No. 2—Assists No. 1 to attach the trail eye to the vehicle.
Replaces the breech cover.
Places the oil can wallet on the vehicle.

No. 3—Removes and houses the flash eliminator.
Replaces the muzzle cover.
Puts the cleaning rod wallet on the vehicle.
Assists the G.D.C. to put any ammunition boxes on the vehicle.

On the completion of the above duties the detachment will take up positions in the vehicle.

Notes

1. If the vehicle is able to approach the action position, "cease firing" and "limber up" will be carried out consecutively, with the exception that the towing bar will not be removed from its housing.

2. If ten-round containers are in use, No. 3 will be responsible for seeing that they are all put on the vehicle.

Lesson 7—Load—Fire—Unload—Stop

To Load.—On the command "load" from the G.D.C., No. 2 inserts a round in the breech and pushes it home with his left hand. He will reload as soon as the gun has been fired. Each time the gun is correctly loaded he taps No. 1 on the shoulder.

To Fire.—No. 1 presses the trigger with his right hand.
The initial round is fired after the G.D.C. has given the order "fire" and as soon as No. 1 has laid on his target. Subsequent rounds will be fired by No. 1 after he has received a tap on the shoulder from No. 2 indicating that the gun is loaded. He must ensure that he releases pressure on the trigger as soon as the gun has fired.
To Unload.—No. 2 opens the breech, No. 1 firing the mechanism as soon as the breech is closed. If a live round is being unloaded No. 2 will ensure that the round does not fall on the ground when it leaves the breech.

To Stop.—On the order "stop," No. 2 will replace in the container the cartridge which he is holding. He will then unload.

Lesson 8—Misfire drill. Casualties

1. Action on misfire.—If the gun fails to fire, No. 2 will report "misfire." During practice firing one minute will be allowed before any action is taken. The G.D.C. will then order "unload misfire," and No. 2 will unload.

If the round has been struck he will reload with a new round and carry on firing.

If the round has not been struck there is a fault in the firing mechanism. The mechanism will in that case be stripped down and the broken part will be replaced.

2. Casualties.—In the event of a casualty the remainder of the detachment will maintain the gun in action as best they can. In an emergency one man is capable of loading, laying and firing the gun, though necessarily the rate of fire will be decreased.
SECTION 5—STRIPPING

Instructor's Notes

Stores.—Complete equipment, spare parts and tools.

1. No force should be used in stripping or assembling any part of the gun.

2. Use the correct tools for the task.

3. Speed should not be attempted.

4. All parts should be put in a clean place and before assembling care should be taken to ensure that no grit, etc., is on the parts.

5. After stripping and assembling the correct functioning of the parts will be tested.

6. During stripping and assembling the parts should be named and the squad frequently questioned.

7. Only the parts named below should be stripped by others than skilled artificers. On no account will any packing glands, stuffing boxes, etc., be interfered with by anyone but a skilled artificer.

8. Alternative names, which may already be in use for some of the parts, are given in brackets on the first occasion that the part is named throughout this and the following sections.

Lesson 9—To strip and assemble the breech

1. To strip the breech.

With the T bar remove the actuating spring (wedge closing spring).

Loosen the capstan nut (wedge stop screw).

Place the left hand under the breech block (wedge).

Pull back the crank handle with the right hand to its fullest extent and remove the breech block.

Disconnect the actuating plate.

Remove the extractor from its seating.

2. To assemble the breech.

Replace the extractor.

Ensure that the breech is cocked.

Assemble the breech block to the breech ring ensuring that the cam on the crank shaft is in its slot, return the crank handle to its forward position. (During this movement ensure that the extractor is in its correct position.)

Tighten the capstan nut and assemble the actuating spring.
Lesson 10—To strip and assemble the breech block

1. **To strip the breech block**

   Fire the mechanism.
   Insert a screwdriver at the base of the mainspring, press down and disconnect the trunnions from the claws of the spring.
   Remove the mainspring.
   With a hammer and drift remove the sear spring.
   Remove the sear.
   Ensure that the trunnion swivel is clear of the seating on the rocking shaft, and then drift out the rocking shaft.
   Remove the striker post (firing hammer).

2. **To assemble the breech block**

   Replace the striker post.
   Replace the rocking shaft ensuring that the trunnion swivel is clear.
   Replace the sear.
   Replace the sear spring using a hammer and drift (ensure that the spring is the correct way up).
   Replace the mainspring.
   Cock the mechanism by pressing down on the arm of the rocking shaft before replacing the breech block in the breech ring.

**Notes**

1. For all drill and training purposes, the spring link (drill hook) must be attached between the trunnion claws and the mainspring. This prevents undue tension being placed on the mainspring.
2. This spring link must be removed before carrying out any firing.
3. The mechanism should never be left cocked for any length of time as extra tension then on the mainspring will weaken it.

Lesson 11—To remove and replace the barrel

1. **To remove the barrel**

   Remove the flash eliminator.
   Ensure that the barrel is slightly depressed.
   Remove the split pins from the nuts at the front ends of the buffer cylinder and recuperator cylinder and then remove the nuts themselves.
   Slowly draw back the barrel (this should be done by one man at the muzzle end and two at the breech end; great care
being taken to see that the felt and brass guides on the gun and the brass bush at the front end of the cradle are not in any way damaged during this process).

2. To replace the barrel
Reverse the above procedure. (Again great care must be taken to see that no damage is done either to the guides or the bush).

It is important that the split pins should always be replaced on the buffer and recuperator nuts.

Note.—This operation should only be carried out when necessary for cleaning purposes, or if damage to the guides is suspected.

Lesson 12—To remove and replace the recuperator springs

1. To remove the recuperator springs
Remove the gun and recoil unit complete, as already taught and place it on some firm support.
Loosen the front cap of the recuperator cylinder about six turns, if necessary holding the cylinder tight by using a spanner on the centre flats.
Screw the bronze end of the recuperator springs tool to the end of the springs compressing rod and see that it is screwed well home.
Tighten the nut of the tool until the sleeve bears on the front cap of the recuperator cylinder.
Unscrew the front cap; while unscrewing the front cap unscrew the nut on the tool to follow the movement of the front cap.
Continue to unscrew until the cap is freed from the cylinder.
Remove the whole unit to the front.
Continue to unscrew the nut on the tool until all tension is removed from the springs.

Note.—Make sure that the tool remains firmly attached to the springs compressing rod throughout the whole of the operation.

Remove the tool from the compressing rod.
Remove the springs and parting plate from the compressing rod.

2. To assemble the springs
Assemble the springs, parting plate and cylinder cap in position on the compressing rod.
Fit the front cap over the bush of the tool.
Fit the tool to the end of the rod and screw up the nut of the tool.

Insert the press into the recuperator cylinder and continue to screw up until the springs are sufficiently compressed to allow the front cap to be screwed into position on the recuperator cylinder.

*Note.*—It may be found easier before inserting the press into the cylinder to screw up and put tension on the springs.

When the front cap is secure, ease up on the nut of the tool until the tension of the springs is taken up on the front cap.

Continue to ease off and remove the tool from the compressing rod.

Lesson 13—To strip and assemble the trigger mechanism, and additional parts

1. *To strip the trigger mechanism*
   
   Remove the trigger bar cover by tapping out the two split pins with a small punch.
   
   Remove the rear portion of the trigger bar and the spring behind it.
   
   Remove the front portion of the trigger bar and the spring behind it, disconnecting the bar from the trigger grip.

2. *To assemble the trigger mechanism*
   
   Reverse above procedure, ensuring that both springs are properly connected and in their correct position.
   
   *Note.*—These parts should only be removed to replace broken or damaged parts.

3. *To remove layer's guard*
   
   Pull out the plunger and pull the guard to the rear.

4. *To remove the flash eliminator*
   
   With the flash eliminator spanner unscrew the flash eliminator.

   When assembling, great care must be taken to ensure that the threads are not damaged; no undue pressure will be applied when tightening.

   When the flash eliminator is removed, the muzzle protector must be screwed on in its place.
SECTION 6—MECHANISM

Instructor’s Notes

Stores.—Complete equipment, spare parts and diagrams.

Only those subjects laid out below will be taught to gun detachments, as the man only requires to know the mechanical working of those parts of the gun which he is allowed to strip down himself in order to clean or replace parts. Only an outline of the working of the buffer recoil system will be taught and on no account will anyone other than a skilled artificer attempt to interfere with it, except for the purpose of filling it as laid down in Sec. 7, Lesson 21.

Lesson 14—To open the breech by hand

On pulling the crank handle to the rear and downwards the actuating bar arm on the crank withdraws the actuating bar and at the same time extends the actuating spring (wedge closing spring).

During this movement the cam on the crank moves along the forward concentric portion of the cam groove; meanwhile the cocking arm on the crank bears down on the arm of the rocking shaft which causes the striker to be withdrawn from the face of the breech block.

During this movement the breech block (wedge) has not moved.

The continued movement of the crank handle downwards causes the cam on the crank to ride against the rear eccentric portion of the cam groove, thus forcing the breech block down.

At the same time the cocking arm is still bearing down on the arm of the rocking shaft.

The rocking shaft, which is being forced to rotate during these movements, has keyed to it the striker post (firing hammer), so that the striker post is forced to rotate also. This rotation continues until the bent on the striker post becomes engaged with the bent on the sear which is forced into position by the sear spring.

This prevents the striker post and rocking arm from moving forward again. During this movement the mainspring has been compressed between the rear of the head of the striker post and the trunnion.

As the breech block moves downwards the lug on the extractor is stationary in its groove and eventually its inclined
surface meets the inclined surface of the groove, when it is forced sharply to the rear. This causes ejection of the empty case from the chamber. When the breech block is fully down the bottom of the lug on the extractor is above the flat behind the inclined portion of the groove.

At the same time the plunger on the extractor forces its rear end to the left thus causing the bent on the extractor to engage on the rear of the breech block. This holds the breech block open.

Lesson 15—Opening the breech by semi-automatic action

On the cartridge being fired, recoil takes place and the gun is forced to the rear.

It takes with it the actuating bar which is attached to it. When the bent on the actuating bar has passed the end of the actuating bar platform the actuating spring forces the bar downwards until the bent has engaged behind the rear end of the platform.

When the recoil energy has been absorbed by the buffer, the recuperating springs take charge and take the gun forward again. The actuating bar is unable to move forward as the bent is engaged, so the crank is forced to rotate. This causes exactly the same movements to take place in the breech as for opening the breech by hand.

The final rotation of the crank forces the tripping arm to kick sharply on the underside of the actuating bar which causes the bends to disengage. The actuating bar is now free to go forward with the barrel, and upward movement of the breech block is arrested by the action of the extractor engaging the rear of the breech.

Lesson 16—To close the breech

On placing a round in the chamber, the rim of the cartridge forces the front of the extractor forward and to the left, thus disengaging the bent from the rear of the breech block and the bottom of the lug from the flat on which it is resting.

The breech block is now free to move upwards under the influence of the actuating spring.

The chamfer on its upper edge and the inclined movement of the breech block give the final motion of seating the cartridge in the chamber should it still protrude.

The upward movement continues until the cam on the crank meets the concentric portion of the groove in the breech block. Further rotation of the crank causes the cam to travel
along the concentric groove until the crank passes in front of its dead centre, thus forming the means of retaining the breech block in the closed position by its own weight.

If it is desired to close the breech without inserting a cartridge, the weight of the block should be taken by pulling back slightly on the crank handle. The rear of the extractor can then be moved to the right and forwards to clear it, and the breech can be eased upwards by controlling the movement of the crank-handle.

Lesson 17—Firing action and safety arrangements

When the trigger lever is pressed, it pivots about its pivot pin, bearing against the front bar of the firing rod and forcing it to the rear, extending the spiral spring. Provided that the gun is fully run-out the pawl at the rear end of this bar forces the rear firing bar back and the rear end bears against the roller of the lug of the firing spindle.

This movement rotates the firing spindle causing the firing lever to press down on the sear, releasing the bents of the sear and the striker post and allowing the mainspring to propel the striker post forward, thus firing the cartridge.

On releasing the trigger the springs cause the spindle and firing bars to take up their original positions.

Should the gun not be fully run-out, the cam roller secured to the gun bears against the projection on the upper surface of the safety cam so depressing it. This cam then presses the toe of the pawl down from the end of the rear firing bar into the cut-away portion of the bar. Therefore the gun cannot be fired from the trigger lever unless the gun is in the fully run-out position.

Should the gun have fully run-out, and pressure be still maintained on the trigger, the safety cam will have been forced down by the cam roller on the gun, thus forcing the pawl down into the cut-away portion. It will not be able to press back the rear firing bar until pressure is released and it can resume its normal position.

Safety arrangements

The gun cannot be fired before the breech is fully closed, for the following reasons:

If the crank-handle is not fully forward, the arm of the rocking shaft will foul the cocking arm on the crank-handle before the striker can go fully forward.

The firing pin is not in line with the primer of the cartridge.

The firing lever will not act on the trigger sear.
Lesson 18—Elevating and traversing gears, recoil and recuperator system

Elevating gear

On rotating the handwheel the movement is transmitted to a worm shaft which is geared to the elevating rack, thereby elevating or depressing the gun.

Traversing gear

On rotating the handwheel the movement is transmitted through a chain drive to the worm shaft, which in turn is geared to the traversing rack on the platform.

Note.—Adjusting screws are supplied for the purpose of taking up backlash in the gears. The elevating adjusting screws turn clockwise and the traversing screws turn anticlockwise.

Recoil and recuperator system

On recoil the recuperator springs are compressed. This gives a braking effect to the backward movement of the barrel. Additional braking is applied by the circulation of oil under pressure in the buffer recoil system. This braking effect controls the distance of recoil which is approximately nine inches.

On "run-out," the recuperator springs carry the barrel forward. The circulation of oil under pressure in the buffer recoil system gives a braking effect to the forward movement of the barrel, minimising metal to metal contact.
SECTION 7—MAINTENANCE

General

1. Thorough cleaning and lubricating are necessary to preserve these equipments, and the operation should be carried out once a week as well as after firing, travelling or exposure to wet. Take every precaution against rough usage to all parts. Nuts and screws must be tightened and split pins inserted, the latter being splayed after insertion. Lost and damaged pins must be replaced at once. Spanners and implements provided should only be used for the purpose intended. Defects and damage must be reported immediately.

2. The gun and fittings

The breech fittings should be frequently taken apart and examined to see that they are sound and in proper working order.

They should be treated with care, violence and jerks being avoided, and no unnecessary force will be applied.

After use the breech should always be left closed, striker spring released, and the breech and muzzle covers fitted.

All spare parts should be tested for interchangeability as soon as possible after receipt.

3. The recoil system

To ensure that the buffer and running-out press are kept in good order, it is important that all adjustments or repairs to them should be carried out by skilled artificers, care being taken to prevent grit or foreign matter from entering the system.

4. The carriage

All moving parts in the carriage should be kept clean, free from burrs and well lubricated.

5. Sighting

Sights will be handled with great care and adjusting screws not disturbed unless necessary.

Telescopes must not be taken to pieces except by a competent person. When not in use, the telescopes must be kept dry by keeping them in their cases.

In no circumstances will the telescope be assembled to the gun when travelling.
6. Lubrication

The following lubricants will be used:—

*Oil C 70*: for cleaning bright parts and general lubrication.

*Oil M 800 or C 600*: for pressure lubrication (Tecalemit injector).

*Mineral jelly*: as a general preservative.

*Oil, mineral, hydraulic buffer*: for the recoil system.

*Oildag*: for use on gun slides and cradle guideways.

7. Washing

The equipment should never be washed down with a hose.

---

**Lesson 19—Daily cleaning**

*Stores:—Complete equipment, spare parts, Oil C 70, Oil M 800 or C 600, linen.*

In cleaning bright or working parts, in no circumstances must coarse grinding materials be used, such as sand, emery or bathbrick. These will wear the surfaces and cause looseness to working parts. Only those materials which are issued will be used for cleaning.

1. **The barrel**

Open the breech, slightly elevate the gun, dry clean the barrel with the cleaning rod and old linen.

Should the barrel be very dirty, paraffin may be used, but care must be taken to ensure that all trace of paraffin is removed.

Re-oil the barrel, using Oil C 70.

*Note*. The cleaning rod bush will always be used when cleaning the barrel.

2. **The breech mechanism**

Open the breech.

Clean the mechanism without stripping.

With C 70 re-oil the parts, particular attention being paid to all frictional parts.

3. **The carriage**

All surfaces of the carriage will be cleaned and unpainted parts lubricated.
4. **Sighting**

The exterior of the telescope and the interior of the telescope bracket should be cleaned, care being taken that no oil is allowed to set on the lenses of the telescope.

The lenses will be cleaned with a piece of dry soft cloth which should be kept for this purpose only.

---

**Lesson 20—Weekly cleaning**

*Stores.*— *As for daily cleaning.*

During weekly cleaning, cleaning and general examination of the gun and equipments will be made.

1. **The barrel**
   
   Clean, dry and re-oil.

2. **The breech mechanism**
   
   Strip, thoroughly clean and re-oil.

3. **Lubrication**

   General lubrication will be carried out at least once a week and particularly before travelling. After lubrication the parts should be worked to circulate the lubricant.

4. **Recoil system**

   As a preventative against corrosion and pitting of the buffer system the gun will be pulled back two or three times.

---

**Lesson 21—Points before firing**

*Stores.*— *As for weekly cleaning with the addition of "Oil, Mineral, Hydraulic Buffer".*

*The buffer*

1. Under peace conditions no other liquid other than the correct service buffer oil may be used. On active service, should the supply of correct oil fail, any ordinary lubricating oil may be used, and in extreme cases even water may be used. These alternative liquids may quite possibly cause damage to the recoil system if left for any length of time, therefore every effort will be made to obtain a supply of the correct oil as soon as possible.

2. In no circumstances whatever will buffers be filled with illuminating oils such as paraffin or kerosene or explosive oil such as petrol be used.
3. Oil drained from the buffer cylinder should not be used again except in an emergency.

4. During severe weather the buffer should be protected as much as possible from the cold, in order to prevent the liquid contents from freezing.

   Service buffer oil should remain unfrozen down to a temperature of 20°F.

   Should the liquid become frozen the gun must not be fired and steps will be taken to thaw the liquid. Elevating, depressing and pulling back the gun occasionally will help to prevent the liquid from freezing.

   As a precaution a small quantity of the oil may be removed and replaced with paraffin.

   **Before firing**

   Thoroughly clean, dry and examine the barrel and equipment.

   Lubricate all necessary parts with correct oils.

   Prepare and test, by pulling back, the recoil system.

   Ensure that the spring link is removed.

   Examine telescope and sights.

   Examine and check spare parts.

   Prepare the ammunition.

   Assemble flash eliminator.

   **To fill the buffer**

   1. Level the gun.

   2. Remove the filling nut.

   3. Remove the recuperator nut.

   4. Fill the cylinder to overflow and replace the nut.

   5. Work the barrel backwards and forwards two or three times.

   6. Refill the cylinder and repeat 4 and 5.

   7. Re-assemble the recuperator nut and split pin.

**Lesson 22—Points during firing**

1. **During firing**

   See that the wheel brakes are in the “On” position.

   Careful observance of the performance of the gun must be noted and any faults should be remedied (see table below).

   Sufficient ammunition must be maintained at the gun.

   Empty containers must be removed.

   Any breakages that may occur will be repaired as soon as possible.
The recoil system should be carefully watched during firing to see that recoil and run-out are smooth. Neither should end in a violent impact and the length of recoil should always be about 9 ins.

The following table shows faults that may occur giving the causes and remedies for each:

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| Recoil violent or excessive | (a) Insufficient liquid in the buffer.  
(b) Broken recuperator spring. | Fill the buffer. Replace the spring.        |
| Recoil short | (a) Packing too tight.  
(b) Damaged guide ribs on the gun. | Repack (artificer's work). Repair.          |
| Run-out slow | (a) Packing too tight.  
(b) Burrs or grit on guide ribs. | Repack (artificer's work). Remove obstruction. |
| Run-out violent | Shortage of oil in buffer. | Refill buffer.                              |
| Failure to run-out | (a) Packing too tight.  
(b) Burrs on guide ribs.  
(c) Broken spring. | Repack (artificer's work). Remove obstruction. Replace the spring. |

2. During temporary cessation of firing

The breech mechanism will be cleaned and re-oiled as in daily cleaning.
Check the oil level in the buffer cylinder.
Ammunition supply will be replenished.
Cartridge cases and containers will be collected.
During inclement weather the breech mechanism, muzzle, ammunition and telescope will be covered.

Lesson 23—Points after firing

_Instructor's Notes_

_Stores._ Complete equipment, spare parts, Oil C 70, old linen, boiling water and funnel.

_On the range_

After firing guns will be inspected to ensure that they are unloaded and the striker spring released.
Barrels will be cleaned and thoroughly oiled.
All unfired ammunition to be placed in the containers; empty cases should be checked and placed in their containers on the vehicle.

Remove the flash eliminator and place it on the carriage.
Remove the telescopes.
Release the wheel brakes.
Replace the breech and muzzle covers.
Check all stores, examine the equipment and see that it is in a fit state for travelling.

On return from firing

1. The barrel

Dry the barrel, place an empty case in the chamber and elevate the gun. Fill the barrel as far as possible with boiling water. When the barrel is hot depress the gun and allow the water to run out. Repeat this filling of the barrel as necessary. Dry it and thoroughly clean it with the cleaning brush.

It should then be inspected and re-oiled.
It should be cleaned daily until sweating has ceased.
On no account should soda be used for cleaning the barrel.
If no hot water is available it should be cleaned with the cleaning brush.

2. The breech mechanism

Strip, clean and re-oil
Reassemble the spring link.

3. The carriage

Clean and re-oil as in daily cleaning.

4. Ammunition

All ammunition and empty cases will be checked and returned to the magazine.

5. Inspection

After cleaning, the whole of the equipment will be inspected. All bright parts will be coated with a thin film of Oil C 70.

6. History sheets

All particulars of firing will be entered in the “History Sheet” after firing.
**GENERAL POINTS**

1. When guns are to be stored away for a considerable period, the barrels should be cleaned and examined, then coated with "mineral jelly, red." All unpainted parts of the gun and carriage will be coated with mineral jelly, red.

**LIST OF LUBRICATORS**

<table>
<thead>
<tr>
<th>Position of Lubricator</th>
<th>No. of Lubricators</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunnions:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>1</td>
<td>Screw plug.</td>
</tr>
<tr>
<td>Right</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gear, traversing, sprocket chain (behind hand wheel)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pivot (on top)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bracket, elevating worm (on top)</td>
<td>1</td>
<td>Tecalemit.</td>
</tr>
<tr>
<td>Gear, traversing—bracket, worm gear (facing rear)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Bracket, axle (on top)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Carriage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under right trail leg, near pivot</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ring, guide gun, front (on top)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bracket sight (on top)</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 8—SIGHT TESTS

General

Stores.—Complete equipment, sight testing accessories.

Upon the correct adjustment of all sighting apparatus depends the accuracy of fire.
Sight should be tested frequently and checked preparatory to firing and after prolonged firing.
The sight tests should be carried out with the carriage level transversely and on a firm piece of ground.
The distant object method of testing the sights should normally be used. If a suitable distant object cannot be found the “Target, testing, sights” (Diagram 1) may be used

Diagram 1.
Lesson 24—Sight tests

1. To test and adjust the sights on a distant object

   i. Set the range drum of the telescope at O, taking care that the index line on the body of the telescope coincides with the index line on the telescope holder.

   ii. Open the breech and insert the bore aligning tube.

   iii. Remove the flash eliminator and insert the bore aligning plug in the muzzle.

   iv. By looking through the bore lay the cross-wires on the distant object (which should be at a greater distance than 550 yards).

   v. The intersection of the cross-wires in the telescope (or point of the angle of the sector) should now be on the same point of the distant object. If not, bring it on by means of the adjusting screws for line and elevation on the sight bracket using the tool provided.

2. To test and adjust the sights using the "Target, testing, sights"

   i. Prepare the gun as in i, ii and iii in the previous method.

   ii. Place the target, testing, sights at right angles to the axis of the bore about 55 yards in front of the gun.

   The target must be inclined transversely at the same angle as the carriage if the latter cannot be brought horizontal.

   Care must be taken to ensure that the cross-wires of the bore aligning plug are vertical and horizontal.

   iii. Align the bore cross-wires on the cross of the target.

   The point of intersection of the cross-wires in the telescope (or the point of the angle of the sector) should now be coincident with the top centre of the "T" of the target. If not, adjust as in the first method.
SECTION 9—AMMUNITION

Instructor’s Notes

Stores.—Armour piercing cartridge, practice cartridge and container.

Details of the construction of the cartridge are to be found in the handbook of the 25-mm. Anti-Tank Gun.

Lesson 25—Ammunition

1. The rough usage of ammunition packages and their contents may cause misfires, hangfires, blinds or even premature explosions; consequently, every person who has to supervise work in connection with the handling of ammunition must exercise the utmost care while work is in progress.

Packages containing cartridges should be stacked clear of the ground and covered to protect them from rain and sun and yet permit of a circulation of air.

Cartridges should be sorted and stacked in batches, those of the same batch being placed together.

2. The case

Care should be taken that the cases are not bent or damaged in any way. A bent or damaged case may cause a jam in loading. Cases should be inspected for cracks; a cracked case should not be fired, as it will damage the chamber or breech block.

Cases must be kept clean, and should be rubbed over periodically with an oily rag, if possible. If the case is dirty when a cartridge is fired, it may cause a jam or scoring in the chamber.

If a case becomes separated from its bullet it must not be fired until the bullet has been correctly secured.

The primers will not be removed from the cases after firing except in the case of blank ammunition.

3. The primer

The best results are obtained when the cap is struck centrally. Fired rounds should be inspected for indentation of the cap. If the cap is not struck in the centre, the breech and firing mechanism should be examined.
4. General

Should the cartridge jam and prevent the breech block from closing, it may be forced home or unloaded, but in no circumstances must the case be hammered or tapped with the primer in—the primer must be removed before force is used.

Whenever a jammed cartridge has been extracted, the cause of the jam should be ascertained and the obstruction, if any, removed.

A damaged case must not be reloaded.

5. Types of ammunition and their markings

There are two types of service cartridges, both are armour piercing, but only one has a tracer plug.

Practice ammunition is of two kinds, one is of the shape of the A.P. bullet, the other has a flat head.

These various types may be recognized by the markings given below.

A.P. Bullet . . Point of bullet blackened for about one inch.
A.P. Tracer Bullet . . Point of bullet tinted green for about one inch.
Mark I Practice . . Nose uncoloured.
Mark II Practice . . Bullet truncated.

Letters before or after the Mark of the cartridge have the following significance:—

G. Tracer.
W. Armour piercing.
U. Dummy.
Z. Nitrocellulose powder.
P. Practice.
L. Blank.
SECTION 10—AIMING AND LAYING

General

1. The duties of the G.D.C. for engaging targets are contained in Section 11—Fire Control.

The following lessons apply to No. 1, the layer.

2. It must be remembered that, throughout, the G.D.C. is the fire controller and that No. 1 must be so trained as to interpret automatically to the gun the orders of the G.D.C.

3. It is essential, therefore, that the No. 1 should be an efficient layer and take a correct aim throughout, as it is on the result of each shot that the G.D.C. makes his corrections. If the aim is inaccurate then incorrect corrections will be made.

4. It is emphasized that it is necessary for the No. 1, when engaging moving targets, to follow the target for line by using the traversing handwheel and that this traverse must be continued during the actual pressing of the trigger and after.

The reasons for this are:

i. Between the trigger and the sear in the breech there are a series of the rods and joints. As a result there is a slight delay between the actual pressing of the trigger and the round being fired, this delay or lag may be termed "mechanical lag."

ii. A No. 1, having made up his mind to fire, must impart this intention to his right hand, which at the moment will be on the elevating wheel; there will be delay between the moment he has made up his mind and the time that he actually presses the trigger.

This may be termed "brain lag."

iii. The combination of mechanical and brain lag will cause a considerable loss of lead if the gun is not traversed or swung continuously during the actual process of firing.

iv. The greater the speed of the target, the greater the loss of lead due to the lag if the swing stops when the firer has made up his mind to fire.

Lesson 26—Description of the sights

Stores.—Complete equipment; both types of telescope.

1. The telescopic sight

The telescope is positioned in the holder by a locking screw working in locking recesses.
This screw can be released so that the telescope can be removed.

A rubber eyepiece is fitted at the rear end. A positioning indicator in the form of two red lines is provided to ensure the telescope being in the correct position. It has a focusing adjustment situated at the fore end of the rubber eyepiece in the form of a milled wheel. A locking screw is provided to prevent the focus being altered when once adjusted.

The telescope has a magnification of 4 diameters and a field of view of 11 degrees.

There is a range drum operated by a milled wheel on the outside. This drum is graduated in hundreds of metres from 0 to 35. At the lower ranges every hundred is not marked, and care must be taken in setting the sights at these ranges to ensure the correct range is set. The movement of the range drum also moves the horizontal line within the telescope (see below).

There are two types of telescope, the variations between types being in the markings and graduations inside.

Both types have the range scale marked in hundreds of metres (as on the range drum) on the right of the inside. Opposite this scale is a small arrow so that the layer may set the arrow at any particular range without removing his eye from the eyepiece.

One type of telescope (see Fig. 1) has two cross lines marked on it. The horizontal, having the range arrow at the right end, is graduated with large and small graticules. The distance between two large graticules being 30', and from a large to a small graticule 15'. This horizontal line moves up or down in the field of view according as to whether the range is raised or lowered on the range drum. The correct range being set opposite the arrow.

The other type of telescope (see Fig. 2) has a sector marked on it. On the same horizontal plane as the base of the sector are marked graticules, three on either side, and on the same plane opposite the range scale is an arrow. Range is set in the same way as for the first type.

2. The open sight

This sight consists of a "V" backsight and blade foresight. The backsight may be set by rotation at either 400, 600, 800 or 1,000 metres.

3. Adjustment of telescopic sights

An adjustment is provided on the telescope holder. The method of adjusting is given in Lesson 24.
Lesson 27—Aiming

Instructor’s Notes

Stores.—Complete equipment and vehicles or diagrams of vehicles. Both types of telescope. Aim corrector.

Sequence of instruction:—

i. The correct aim will be illustrated by diagram, explanation and demonstration.

ii. Stationary vehicles should be placed at convenient ranges between 200 and 300 yards facing in varying directions.

iii. A correct aim with both types of telescope and open sight will be laid on each target in turn, each being viewed by all members of the squad.

iv. The squad will now practise taking a correct aim, the instructor ordering a range and lead. By ordering "head away," the instructor can check the aim. If an aim corrector is available the instructor may use that for checking purposes.

1. The types of A.F.V. moving targets that may be engaged are:—

   Direct crossing.
   Diagonal moving.
   Head on.
   Retiring.

2. The sights will always be set at 700 metres unless otherwise ordered.

3. The aim to be taken will vary according to range and the type of target being engaged.

4. At a range of 800 metres or less, which means the bullet has a time of flight of less than 1 sec., the aim will be as follows:—

For crossing targets

The horizontal line, or bottom of line of graticules, across the centre of the target.

The cross line, or point of the angle of the sector, at the nose or front of the target.

For head-on or retiring targets

The horizontal line, or bottom of line of graticules, across the centre of the target.

The cross line, or point of the angle of the sector, at the centre of the target.
5. At ranges over 800 metres, the aim will be as follows:—

For crossing targets

The horizontal line, or bottom of the line of graticules, across the centre of the target.

The cross line, or point of the angle of the sector, or the graticule or fraction of graticule ordered, at the nose or front of the target.

Note.—A table explaining the use of graticules to give "lead" for crossing targets is given at the end of Lesson 29.

For head-on targets

The horizontal line, or bottom of the line of graticules, across the bottom of the target.

The cross line, or point of the angle of the sector, in the middle of the bottom of the target.

For retiring targets

The horizontal line, or bottom of the line of graticules, across the top of the target.

The cross line, or point of the angle of the sector, in the middle of the top of the target.

For head-on or retiring targets over 800 metres range the detachment commander will order the alterations to range in 200’s of metres.

6. For targets moving up or down slopes, aim with point of aim on line of advance of the target.

7. For stationary targets the aim will be with the intersection of the cross lines on the centre of the target.

8. The correct aim with the open sight at ranges under 800 metres will be with the top of the foresight in the centre of the " V " of the backsight at the centre of the target for head on, retiring or stationary targets; the nose or front of the target for crossing targets. The use of the open sight at ranges over 800 metres is not advisable.

9. If a target begins to disappear into a fold in the ground, it will be necessary to "aim down" slightly to ensure hitting that part of the target which is visible.

Lesson 28—Laying

Instructor's Notes

Stores.—Complete equipment, vehicles, flags and aim correctors.

1. When possible, practice in laying should be given out of doors on ground in the vicinity of barracks, using such vehicles
as are available. In wet weather and where no suitable ground is close at hand, practice can be given on the indoor range.

2. The aim corrector, in which is mounted a second telescope for the use of the instructor, must be harmonized with the layer’s telescope. They should be harmonized on to a distant point, both for elevation and direction.

3. The following stages give a suggested sequence for laying instruction:

Stage 1.—No. 1 will be told to lay on moving vehicles, using various leads. The instructor will see that No. 1 is maintaining a correct aim.

Stage 2.—No. 1 will now be required to press the trigger when he is satisfied that he has a correct aim. The instructor will see that No. 1 continues traversing and maintaining the lead ordered whilst actually firing.

Notes.—1. The vehicles need only be at some 200 to 300 yards range. They will move in any direction and at varying speeds.
2. The instructor will order alterations in range and lead to suit the movement of the vehicles.

Stage 3.—Vehicles will now move at prearranged ranges and speeds. The instructor will order corrections for range and lead when necessary. During this stage No. 1 should be getting practice in recognizing ranges and speeds of vehicles.

4. The G.D.C. orders “Target—right (or left).” On this order No. 1 glances round the edge of the shield to pick up the target and then traverses and elevates or depresses the gun until the target is within the field of view of his telescope.

The G.D.C. orders the range followed by the lead. No. 1 sets the sights at the range ordered and lays the correct aim on the target according to the lead ordered. He now maintains his correct aim on the target, firing when ordered by the G.D.C. and continuing to fire as soon as he is satisfied that he again has his correct aim, until he receives the order “stop.” (He must ensure that he has received a tap on the shoulder from No. 2 before firing each round).

5. If a target appears outside the limits of traverse the G.D.C. will order “Trail right (or trail left).” Nos. 1 and 2
will immediately go to the end of the trail and move the gun in the required direction to cover a new area. The target will then be engaged in the normal way.

The G.D.C. should make a point of discovering what part of the target sector the gun can cover when he first brings it into action.

6. After No. 1 has received his fire order and has obtained a correct aim on his target, he will follow his target continuously for line by using the traversing hand-wheel. He must ensure that the graticule or fraction of the graticule ordered is kept on the correct point of aim on the target. He must also ensure that the horizontal line or bottom of the line of graticules is kept on the appropriate part of the target by using the elevating hand-wheel.

Should the G.D.C. order an alteration of lead, No. 1 must immediately aim so that the new graticule or fraction of a graticule is on the nose of the target.

Only by continuous practice will No. 1 become proficient in using the hand-wheels of the gun.
SECTION 11—FIRE CONTROL

General

1. The G.D.C. is the fire controller and with him rests the effective application of fire.

2. He may engage targets under the orders of the platoon commander. These orders are termed “fire direction orders,” and may contain information, when or at what range fire should be opened and the number of rounds that should be expended on any one task.

3. More normally the G.D.C. will be working on his own, and will be responsible for deciding when, and at what range he will engage targets, and for controlling his expenditure of ammunition. He will be responsible for keeping his platoon commander continuously informed regarding his ammunition state.

4. Engagement of targets is by observed fire, corrections, when necessary, being made by observation. In order to hit the target in the minimum number of rounds and so ensure surprise, the fire controller must be well trained in the following:—

- Recognition of targets.
- Judging distance.
- Judging speeds and angle of movement of the target.
- Giving corrections from observations.

Lesson 29—Fire control orders and range table

1. The G.D.C. indicates the target to the No. 1 by ordering “target right (or left),” estimates the speed and angle of approach of the target and orders the lead. He then orders “fire.”

Examples:

(i) Target left
900.
Zero.
Fire.

(ii) Target right
700.
One.
Fire.
2. He will order "stop" as soon as he is satisfied he has recorded a hit on the target. A fresh target can now be engaged.

3. With the help of the tracer plug in the shell the G.D.C. is able to make corrections for range and speed. He will observe the flight of the shell and will be able to recognize a plus or minus shot and whether the shell has passed in front or behind his target. He will order corrections for range and lead according to his observation of fire.

4. If a target is at a range of 800 metres or less the G.D.C. will order a range of 700 metres. This will ensure hitting the target up to this range.

5. The G.D.C. can obtain from the range table given below the correct lead when he has estimated the range, speed and angle of approach of the vehicle.

---

**Range Table (Full Charge)**

<table>
<thead>
<tr>
<th>Range</th>
<th>Speed</th>
<th>Lead (in graticules of 30°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 800</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>$\frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>Over 800</td>
<td>8</td>
<td>$\frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>$1\frac{1}{2}$</td>
</tr>
</tbody>
</table>

1. This table is based on direct crossing targets.

2. A diagonal moving target requires half the lead of a direct crosser.

3. Examples:
   
   (a) Target at 800 direct crossing at 16 m.p.h. requires a lead of $\frac{1}{2}$ graticule.
   
   (b) Target at 1,200 diagonal moving at 16 m.p.h. requires a lead of $1\frac{1}{2}$ graticule.

---

**Lesson 30—Recognition of targets**

1. It is essential for all anti-tank gunners to be able to recognize types of A.F.Vs that may have to be engaged, so as to distinguish between enemy and our own tanks.
2. Instructions will be given in recognizing different types of British A.F.Vs, and from this a further study of different types will be made.

3. For this instruction, diagrams, which are issued to units, will be used. Every opportunity should be taken for visiting tank units and studying the shape and sizes of their A.F.Vs.

4. The outlines of these A.F.Vs, when moving over ground at different ranges, should be memorized and their cross-country performances and speeds must be considered.

Lesson 31—Judging distance

1. The normal methods and sequence of instruction for judging distance are laid out in S.A.T., Vol. 1, Pamphlet 2, 1937, Section 3.

2. The standard of accuracy to be aimed at is to judge distance up to 1,200 yards to within 100 yards of error.

3. The most useful method for judging distance to moving targets is the appearance method. For simplicity, a man should be trained to recognize by the appearance of the A.F.V. that it is at a particular range. He should be trained to recognize all types of A.F.Vs at ranges of 800 yards and 1,200 yards.

Vehicles should be put out at these ranges and a man taught to recognize the variation of the appearance of the vehicle at each range. Particular attention should be paid to the variation of light and background as enumerated in S.A.T., Vol. 1, Pamphlet 2, 1937, page 22, different conditions being selected for this practice.

4. Screens of canvas can be constructed to form the outline of medium and light tanks. These can be hooked on the sides of vehicles and thus represent tank targets.

5. After sufficient training has been given in judging A.F.Vs at 800 and 1,200 yards, a simple test in judging distance should be carried out.

Four tanks or vehicles representing tanks should be placed out at known ranges.

The permissible error will be 100 yards, and estimation of ranges should be given to the nearest 50 yards.

To pass, a man should judge correctly to within the permissible error on all four targets.
Lesson 32—Judging speed and angle of movement

1. In judging the speed and angle at which a target is moving, very little time is available for applying aids. A rough estimate must be made, and then, by observing the flight of the first round fired, it will easily be seen whether and by how much the initial estimate was wrong, and a correction can be made.

2. Men should be trained to recognize A.F.Vs moving at three speeds, 8, 16 and 24 miles per hour. Vehicles should be put out and made to move at these speeds, and after a certain amount of practice no difficulty should be found in recognizing these speeds.

Different types of A.F.Vs should be represented, as the appearance of light and medium tanks is deceptive when moving at the same speed. For the higher speed of 24 miles per hour, only light tanks, or vehicles representing light tanks should be used.

3. Men must also be trained to differentiate between head-on, crossing and diagonal targets and to judge the amount of lead that is required.
SECTION 12—ROUGH GROUND HANDLING

Lesson 33—Rough ground handling

Stores.—Complete equipment, one pick, one shovel.

1. Rough ground handling forms a very important link between drill and handling in the field. Previous to this the gun numbers have had no practical experience in bringing up gun into action on uneven ground or in mounting it with reference to any particular sector. Here the first references are made to use of ground and cover and simple tactical situations may be included.

2. Instruction will begin with mounting the gun on uneven ground to show the gun numbers how the legs of the gun must be mounted to keep the barrel in the vertical plane. The wheels may be mounted on uneven ground provided the axle does not make an angle of more than 9° with the horizontal.

3. After this preliminary stage, the detachment will be taught how to manhandle the gun over various types of ground. The detachment commanders should learn to recognize by eye the type of slopes and terrain over which the gun can be manhandled.

4. When the detachment is pushing the gun up or down a slope, it will be found more effective if two of the numbers push or hold the wheels as more purchasing power can be obtained in this way than by exerting pressure on the shield.

5. The trail should always face down the hill whether the equipment is being moved up or down a slope. The trail should be kept as close to the ground as possible.

6. If drag ropes can be obtained they can be fixed to the front towing ring and the equipment can be pulled up a slope.

7. It may be found necessary to cut away earth or turf to let a leg down or to build up under a leg in order to get a level mounting for the gun. Always remember that the barrel should be in the vertical plane.

8. Concealment and camouflage should be practised during this period of the detachment’s training.
SECTION 13—BATTLE PROCEDURE

General considerations

1. The following points should be borne in mind in bringing the guns into action:—

Each detachment forms a self-contained fire unit.
The gun cannot be manhandled over long distances, particularly over wet and heavy ground.
The barrel clearance is small and the trajectory of the shell is flat.
Once the gun has opened fire, it may easily be detected by the flash and noise.

2. From these points arise the following principles:—

The vehicle must bring the gun as close as possible to the selected action position.
Fire must be withheld for as long as possible.
The platoon commander will often be able to lay down a policy as to how soon and at what range fire is to be opened. Fire should be opened at a range at which it is certain that direct hits can be recorded, but, at the same time, fire should be opened soon enough to enable a tank attack to be stopped before it reaches the defences protected by the guns. The limit of range at which fire is opened will depend greatly on the number of tanks approaching in each gun's target sector.
Definite safety rules cannot be laid down, but overhead fire should not be employed. Guns will have to be sited in conjunction with defended localities.

Lesson 34—The platoon commander's procedure

1. The platoon commander, having received orders regarding the area of responsibility for his platoon and the area for his guns, will:—

i. Order his platoon to a selected rendezvous.
ii. Make a reconnaissance and decide on—
The number of guns required for the task.
The gun area and target sector for each gun.
Target sectors should overlap when possible.
Areas for reserve guns, and areas to which reserve guns can move in case they are required and lines of approach to these areas.
The amount of time at his disposal for getting guns into position.
The amount of ammunition required.
The position of platoon headquarters.
iii. Issue orders to his detachment commanders, using, when possible, a place from which they can see their target sectors. These orders will include the disposal of vehicles, which may be either under platoon or detachment control.

2. When making his reconnaissance, the platoon commander should bear in mind the following:—
   Guns must be defiladed when possible.
   Likely lines of tank attack.
   The use of natural or artificial tank obstacles for flank protection.
   Alternative gun areas for his detachment. These may have to be occupied after a tank attack has been driven off and the original positions of the guns have been located by the enemy. The platoon commander will normally be responsible for issuing the orders for a move to an alternative gun area.

Lesson 35—Reconnaissance for gun positions

1. When carrying out a reconnaissance for a gun position, the G.D.C. must always be clear regarding the amount of time that he has at his disposal both for making his reconnaissance and for getting his gun into action.

2. The G.D.C. should consider the following points:—
   Can his gun cover the target sector ordered from the position chosen?
   Has it a good field of fire at various ranges in that sector?
   How the considerations of safety of our own troops affect the siting of the gun.
   Is he making the best use of available cover? (From the air, from the front and flanks.)
   Are there any obvious landmarks near the gun position?
   Is he making full use of local tank obstacles for the protection of his gun?

3. Having considered the points enumerated above, the G.D.C. will decide on the actual gun position and the direction in which the barrel will point.

4. The G.D.C. must also decide on the best covered approach for the vehicle to the position. If the vehicle cannot get to the position, he must decide on the best route for the team to manhandle the gun forward, giving due consideration to cover and flat ground.
5. He must decide on what camouflage equipment is necessary and whether any tools will be required, as these must be removed from the vehicle before it goes back.

6. He must choose a position under cover for the vehicle to which it will go back. The driver must be informed to where he is to return if called or signalled for in the event of the detachment being required to move. If the gun is to be manhandled into position, this position for the vehicle to return to must be the nearest covered one to the actual gun position.

7. He must choose a covered line of approach to the position from the vehicle position. The whole detachment must know this for ammunition supply, replacement of spare parts and message-carrying purposes. He will reconnoitre for an alternative position.

8. Some of these points will have to be dispensed with if time is not available for a full reconnaissance. The points enumerated in paragraphs 2, 3 and 4 are of primary importance.

Lesson 36—Occupation of gun positions

Instructor’s Notes

Stores.—Complete equipment, ammunition containers, pick and shovel, camouflage.

1. The G.D.C., when he has completed his reconnaissance, will get his gun into action. The following points require attention:—

i. Signal the vehicles forward from the position where he left the detachment, indicating the direction of approach for the vehicle.

ii. On the arrival of the vehicle at the chosen position, order “number of containers—prepare for action.”

iii. Give orders for any tools, camouflage equipment and extra stores to be taken from the vehicle.

iv. Get the gun mounted in the position chosen and give information to all members of the detachment on the following points:—

The target sector.
Likely lines of tank attack, pointing out any tank obstacles there may be in the sector.
The position of neighbouring guns and infantry posts.
The vehicle’s position.
The position of platoon H.Q.
v. Send the vehicle to the covered position he has chosen, giving orders to the driver to look out for signals and informing him of the position to which he is to return if signalled for.

vi. Give orders on the following points, when applicable:

Digging of emplacements for the personnel and/or for the gun, and concealment of the gun.
Roster of observers.
Position for the observer.
Action in case of alarm, and an alarm post for detachment to use their rifles in case of necessity.

vii. Get in touch with neighbouring posts of our own troops, informing them of his position in action and his target sector.

viii. Make a sketch and range card of his position, obtaining, where possible, any accurate ranges from neighbouring troops. The sketch should give his gun position and alternative fire position and the target sector, indicating any pieces of dead ground that may be in that sector.

ix. When possible go forward and inspect the camouflage of his position from the front making any adjustments to suit conditions of background and light.

x. Send a message to his platoon commander as soon as his gun is in action.

2. It is emphasized that the points outlined for consideration in Lessons 34, 35 and 36 are comprehensive and apply in full only to occasions when there is no immediate likelihood of enemy attack, and time is no object.

In the early stages of training detachments must be taught to consider all these points but in the later periods work must be speeded up and the tactical setting varied from the deliberate occupation of a fully concealed and protected position, to action to meet a tank attack which develops while the gun and vehicle are still on the move.

Lesson 37—Procedure special to withdrawal

The following points will have to be considered in carrying out a withdrawal.

1. The platoon commander

i. He will decide on a platoon rendezvous, where he will assemble his gun detachments before moving back to occupy fresh positions.
ii. He will reconnoitre, or send his platoon serjeant to reconnoitre intermediate gun areas that may have to be occupied to cover the withdrawal of other guns and troops from a rearguard position, or to cover a flank move by enemy tanks. He must bear in mind the maximum effective range of his guns when considering these gun areas.

iii. He will give clear orders to his G.D.Cs saying when they will withdraw and how they will receive this order. The withdrawal may be by time, may be ordered or signalled by himself personally, or may be in a message sent by orderly.

2. The G.D.C.

i. He will consider the time at his disposal when occupying the initial rearguard position. (See Lesson 36, 2.)

ii. He will reconnoitre, whenever possible, his line of withdrawal from the action position to the platoon rendezvous. He should take the vehicle driver with him when making this reconnaissance. He may delegate this duty to the driver if the situation does not permit of him going personally.

iii. He will decide the point to which the vehicle can come to limber up the gun. (This position should be as close to the action position as the situation allows.) He will give clear orders to the detachment as to the collection of equipment and stores on his command "limber up."

vi. If an intermediate position has to be occupied he will, if the situation permits, reconnoitre the line of approach to this position.

Lesson 38—Field signals

1. "Action."—Both arms fully extended, raised from the sides to a position level with the shoulders and lowered again. The motion to be repeated quickly several times.

2. "Cease firing."—The arm swing in a circular motion in front of the body.

3. "Fire."—The right arm extended above the head and dropped to the side.

4. Semaphore signals

i. "A." G.D.C. to join immediate superior.

ii. "AA." All N.C.Os to join immediate superior.

iii. "B." More ammunition required at gun position.

iv. "H." Vehicles to move up either to the position from which the signal is given or to a pre-arranged place.
## SECTION 14—SPARE PARTS

### Lesson 39—Spare parts

**Instructor's Notes**

*Equipment complete with spare parts.*

1. **Contents of spare parts box:**

<table>
<thead>
<tr>
<th>Article</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carried in upper tray:</strong></td>
<td></td>
</tr>
<tr>
<td>Spanners, No. 793</td>
<td>1</td>
</tr>
<tr>
<td>&quot;&quot; No. 794</td>
<td>1</td>
</tr>
<tr>
<td>&quot;&quot; No. 795</td>
<td>1</td>
</tr>
<tr>
<td>&quot;&quot; No. 798</td>
<td>1</td>
</tr>
<tr>
<td><strong>Carried in lower tray:</strong></td>
<td></td>
</tr>
<tr>
<td>Apparatus, running-out springs, 25 mm., Mark 1</td>
<td>1</td>
</tr>
<tr>
<td>Box, small stores</td>
<td>1</td>
</tr>
<tr>
<td>Packing, grease, 6 x 400 mm. (for stuffing box)</td>
<td>1</td>
</tr>
<tr>
<td>Ring, packing, stuffing box</td>
<td>2</td>
</tr>
<tr>
<td>Washer, packing, filling plug</td>
<td>4</td>
</tr>
<tr>
<td>Washer, packing, control rod</td>
<td>4</td>
</tr>
<tr>
<td>Washer, packing, control rod head</td>
<td>2</td>
</tr>
<tr>
<td>Box, small stores</td>
<td>1</td>
</tr>
<tr>
<td>Hook, drill</td>
<td>1</td>
</tr>
<tr>
<td>Pin, firing</td>
<td>1</td>
</tr>
<tr>
<td>Pin, key, split 3 mm.</td>
<td>16</td>
</tr>
<tr>
<td>&quot;&quot; 4 mm.</td>
<td>6</td>
</tr>
<tr>
<td>&quot;&quot; 5 mm.</td>
<td>6</td>
</tr>
<tr>
<td>Plug, filling or drain hole</td>
<td>2</td>
</tr>
<tr>
<td>Spring, extractor</td>
<td>2</td>
</tr>
<tr>
<td>Can, lubricating, 1½ pints</td>
<td>1</td>
</tr>
<tr>
<td>Funnel, filling, buffer</td>
<td>1</td>
</tr>
<tr>
<td>Injector, Tecalemit</td>
<td>1</td>
</tr>
<tr>
<td>Plate, parting, running-out springs</td>
<td>1</td>
</tr>
<tr>
<td>Spanners, No. 792</td>
<td>1</td>
</tr>
<tr>
<td>&quot;&quot; No. 796</td>
<td>1</td>
</tr>
<tr>
<td>&quot;&quot; No. 797</td>
<td>1</td>
</tr>
<tr>
<td>&quot;&quot; No. 799</td>
<td>1</td>
</tr>
<tr>
<td>Springs, running-out</td>
<td>2</td>
</tr>
<tr>
<td>Tool, artillery, No. 202</td>
<td>1</td>
</tr>
</tbody>
</table>
**HOLDALL, 25 mm., No. 1, MARK I**

<table>
<thead>
<tr>
<th>Article</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carried in 1st compartment:</strong></td>
<td></td>
</tr>
<tr>
<td>Hammer, copper</td>
<td>1</td>
</tr>
<tr>
<td>Spanner, adjustable</td>
<td>1</td>
</tr>
<tr>
<td>Extractor</td>
<td>1</td>
</tr>
</tbody>
</table>

| **Carried in 2nd compartment:** |
| Tool, artillery, No. 203       | 1   |
| Screwdriver, 25 mm., Mark I    | 1   |
| Tommy, No. 87                  | 1   |
| Screwdriver*                   | 1   |
| Tommy, No. 88                  | 1   |

| **Carried in 3rd compartment:** |
| Firing hammer, with pin and stirrup | 1 |
| Springs, main                     | 2   |
| , closing, wedge                  | 1   |
| Tool, artillery, No. 204          | 1   |
| Springs, trigger-sear             | 1   |
| Sear, trigger                     | 1   |
| Spring, Part I, firing rod        | 1   |
| Part II                          | 1   |
| Spring, torsion, firing spindle   | 1   |

* For breech fittings, also filling and draining plug.

---

**HOLDALL, 25 mm., No. 2, MARK I**

<table>
<thead>
<tr>
<th>Article</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaner, bristle</td>
<td>1</td>
</tr>
<tr>
<td>Cleaner, wire</td>
<td>1</td>
</tr>
<tr>
<td>Guide, cleaning rod</td>
<td>1</td>
</tr>
<tr>
<td>Pull-through</td>
<td>1</td>
</tr>
<tr>
<td>Rod, cleaners and pull-through (in 4 parts)</td>
<td>1</td>
</tr>
</tbody>
</table>

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**BAG CLEANING MATERIALS, 25 mm., MARK I**

<table>
<thead>
<tr>
<th>Article</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box, grease</td>
<td>1</td>
</tr>
<tr>
<td>Can, oil</td>
<td>1</td>
</tr>
<tr>
<td>Cloths, cleaning</td>
<td></td>
</tr>
<tr>
<td>Tin, petrol</td>
<td>1</td>
</tr>
</tbody>
</table>
SYLLABUS FOR TRAINING IN ANTI-TANK GUN

For all numbers of the detachment

<table>
<thead>
<tr>
<th>Subject</th>
<th>Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>General description</td>
<td>1</td>
</tr>
<tr>
<td>Mechanism</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Gun drill</td>
<td>6 (2)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Stripping</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Sight tests</td>
<td>1</td>
</tr>
<tr>
<td>Ammunition</td>
<td>1</td>
</tr>
<tr>
<td>Aiming and laying</td>
<td>5</td>
</tr>
<tr>
<td>Fire control</td>
<td>3</td>
</tr>
<tr>
<td>Rough ground handling</td>
<td>3</td>
</tr>
<tr>
<td>Battle procedure</td>
<td>8</td>
</tr>
<tr>
<td>Lectures</td>
<td>5</td>
</tr>
<tr>
<td>Firing practice (full scale)</td>
<td>4</td>
</tr>
<tr>
<td>Firing practice (1/30 scale)</td>
<td>3</td>
</tr>
</tbody>
</table>

Each period of 50 minutes duration.
Figures in brackets are for mutual instruction.
The above syllabus is for a two weeks course.