EXTRACTS FROM:

B. R. 219/38

NOTES ON GUNNERY

FOR

DEFENSIVELY EQUIPPED MERCHANT SHIPS.

1938

BOOK 1

SECTION 1 --- GENERAL INSTRUCTIONS.

RESPONSIBILITY OF MASTER.

The armament of a merchant ship is only to be used for self defence.

Every merchant ship has the right to resist capture or destruction. It must, however, be realized that once she has opened fire the enemy is entitled to sink her without further delay.

THE DECISION TO OPEN FIRE OR NOT IS ENTIRELY THE RESPONSIBILITY OF THE MASTER.

The responsibility for ceasing fire is his also.

Before opening fire the British colours must be hoisted.

STATE OF READINESS OF GUN.-- At sea or when the ship is anchored in a place where she is liable to attack the gun is to be kept cleared away, but not loaded, and a ready supply of ammunition is to be kept handy. The ammunition should be protected from the weather; the gun may be covered to keep it dry.

When in a protected harbour the ammunition is to be kept in the main magazine, and the gun kept covered except when it is being cleaned.

STATE OF READINESS OF GUN'S CREWS.-- Whenever the gun is cleared away, one trained rating is to keep a continuous lookout near the gun, By day the other trained ratings should be close at hand; by night they should sleep nearby

ALARM SIGNAL.-- An alarm signal should be arranged, which can be worked from the bridge, to warn all hands to go to action stations.

STATUS OF GUN'S CREW.-- The gunlayer and seaman gunners are under the authority in the same respect as are the rest of the crew of the ship, In accordance with the Merchant Shipping Act.

At sea these ratings are not to be employed on duties other than those connected with the armament and lookout, except in case of emergency; They are however, at all times to assist in the welfare of the ship and to look after the cleanliness of their berths.

In harbour they are not to be employed on the ordinary work of the ship, but are to attend to the armament. One is always to remain on board.

RESPONSIBILITY OF GUNLAYER.-- The gunlayer is responsible, under the master, that the gun and gun's crew are in the state of readiness laid down in these orders.

He is responsible that the gun, mounting and ammunition are kept efficient; and also for the upkeep of any small arms, smoke apparatus, fireworks or other armament stores that may be supplied to the ship.

He is responsible for the preliminary instruction and training of the guns crew and supply party, and for theirm periodical drill after they have learnt their duties.

He is in charge of the other trained ratings both as regards their duties in connection with the upkeep of the armament and such other duties in connection with the cleanliness of their berths, etc. as may be directed by the master.

In case of doubt or difficulty he should refer to an officer or instructor at the first opportunity.

RESPONSIBILITY OF SEAMAN GUNNER's.-- The seaman gunners are responsible to the gunlayer for any duties for which they are detailed.

OFFICER INSTRUCTORS.-- Naval officer instructors are stationed at many of the principle ports in war time. they will assist in all matters concarning the armament and equipment of defensively equipped ships and the training of their crews

in defensive measures they should be consulted by the master or the gunlayer in any case of doubt or difficulty.

SECTION II -- ORGANIZATION.

GUN'S CREWS.-- The trained rating will carry out the duties of gunlayer, breechworker and trainer respectively.

As many other men as may be required to complete the guns crew will be selected by the master from the rest of the crew of the ship.

All these men are to be instructed and drilled by the gunlayer. The master should arrange for the drills to be started as soon as possible after the gun is installed; they should be continued daily until all hands are efficient, and then at least once a week.

The sightsetter is the most important number at the gun after the gunlayer, breechworker and trainer. The quickest and most reliable man available should be selected for this duty; he must have good bearing. He will require more practice than the remainder of the guns crew.

The most powerful man available should be selected as projectile number at 6" guns.

The crews required for each type of gun are as follows:-

6-in and 5.5" B.L. guns	4.7" and 4" B.L. and Q.F. guns	4",3" and 12 pdr H.A./L.A guns
No.1 Gunlayer	Gunlayer	Gunlayer
No.2 Breechworker	Breechworker	Breechworker
No.3 Rammer No.	Rammer No. or Trayworker	Loader or Trayworker
No.4 Trainer	Trainer	Trainer
No.5 Loader	Loader or Projectile sup.	Ammunition supply.
No.6 Cartridge supply	Cartridge supply	Ammunition supply
No.7 Loader	Sightsetter	Sightsetter
No.8 Cartridge sup.		Fuzesetter#
Sightsetter		Fuzesetter#

Fuzesetter are required for H.A. fire only.

SUPPLY PARTY.-- In addition to the guns crew a party will be required for supplying ammunition fromthe magazine to the gun the number of men in this party, if the size of the ships crew will admit, should be sufficient to supply the gun at the right of 6 rounds per minute.

It should be borne in mind that in the presence of an enemy extra firemen will probably be required below to get the maximum speed out of the ship.

When organizing the ship for action,every man in the ship should be used if possible. Men are more likely to remain steady under fire if they have some definite duty to perform.

CONTROL OFFICER.-- The master must decide whether to detail a Control Officer or not: basing his decision on whether he has an officer with any gunnery training or experience. If no control officer is available the gunlayer must carry out the duties of contro, officer as well as his own.

Experience has, however, shown that much better shooting will result if the gun is controlled by someone independent of the gunlayer.

The question of detailing a control officer is one on which the master should seek the advice of an officer instructor at the first opportunity.

SECTION 3.-- DRILL.

As soon as the gun crew as supply party have been detailed they are to be instructed in their duties and drilled by the gunlayer.

Until everyone knows his work the supply party should be drilled at a different time from the guns crew.

More value is obtained by short and frequent drills than by long anf infrequent ones. One hour is long enough for any one drill. In the early stages of training more than one drill may be carried out in a day.

PRELIMINARY DRILL.- When starting to teach gun drill to an untrained crew certain preliminary drill is necessary until each man knows his duties. This is common to all guns and is given below. During preliminary drill the gunlayer should teach each number of the gun's crew how his special duty is to be done by first doing it himself and then seeing the man do it.

GUN DRILLS.- As soon as each man knows his special duties the crew must be taught to work together, and for this purpose a gun drill is laid down for each type of gun.

The following four drills (detailed on page 8, 14, 19, 51) will cover all the guns mounted in DEMS.

(a) Drill for B.L. guns
(b) Drill for Q.F. guns with swinging breech blocks.
(c) Drill for Q.F. semi-automatic guns.
(d) H.A. drill for Q.F. guns.

METHOD OF CARRYING OUT PRELIMINARY DRILL.- Fall in the crewww in rear of the gun in a single rank in the order of their numbers from right to left.

NUMBERING.

At the order"number" each man in succession calls his number sufficiently loud for the rest of the crew to hear.

DUTIES AT THE GUN.

The gunlayer calls out each man number and states his general duties, e.g.:--

"One-- gunlayer, lays and fires the gun.

"Two-- breechworker, in charge of loading,etc." and so on as laid down in the drill for the particular gun.

The gunlayer then teaches the following:-

CLOSING UP IN SLOW TIME.

At the order "Close up" one only, moving at the double, places himself at the elevating wheel, if No. 1 is drilling the crew he will then leave the elevating wheel and take up the position from which he can best direct the drill.

Each menber of the crew will then close up, seperately as his position and number are called,

"On the right in line with the breech facing the muzzle. Two", and so on as laid down in the drill for the particular gun.

FALLING OUT IN SLOW TIME

At the order"Fall out" one only places himself in rear of the gun, leaving sufficient room on his left for the rest of the gun's crew.

Each menber of the crew will then fall out seperately as his position and mumber are called, e.g.:-

"On the left of one. . . . . .2.
"On the left of twp. . . . . .3.
and so on.

CLOSING UP IN QUICK TIME.

At the prder "Close up" all number moving together will close up as already detailed.

"STILL" and "REST"

The order "Still" is given to prevent an accident.

At that order all numbers remain perfectly still. Nothing cancels the order "Still" except the order "Carry on" when the last order is carried put. (Anybody can give the order "Still" and should do so to prevent an accident.)

To stop the drill for instructional purposes the order "Rest" is used. At that order all numbers turn to face the instructor and stand at ease those carrying weights placing them on the deck.

The instructor gives the order "Rest" to point out mistakes or give fresh details.

Nothing cancels the order "Rest" except the order "Carry on" when the last order given is carried out.

DRILL FOR B.L. GUNS.- The fol owing drill is for use at a 6" or 5.5" B.L. gun. It is applicable to 4.7" and 4" B.L. guns also, omitting nos.8 and 9, No. 7 becoming Sightsetter.

CLOSING UP.

Positions of the gun's crew when closed up:-

At the elevating wheel .. .. ..1 gunlayer (G.L.)
On right, in line with breech, facing muzzle . . .. ..2 breechworker and in charge of loading.

In rear of 2 .. .. 3 rammer number.
At the training wheel .. .. .. 4 trainer (T)
On left, in line with breech ..
facing 2 .. .. 5 loader.
On right of 5, facing muzzle .. 6 cartridge supply.
In rear of fice .. .. 7 loader
In rear of six .. .. 8 cartridge supply.
Facing the sights.. .. .. ..99 sightsetter (SS)

CAST LOOSE

On going to sea the gun will be cast loose.

All numbers clear away obstructions in the way of working the gun.

5 and 6 remove the gun's securing chains.

T. raises housing stop.

G.L. and T. move the gun through the full limits to seethat all is clear.

T. provides telescopes and passes one to G.L.; both then ship, focus and adjust the power of telescopes.

G.L. examines the percussion firing gear.

2 opens the breech, examines it and sees the percussion lock is shipped and the folowing provided:-

Spare persussion lock Percussion tubes in belt
Vent clearer Firing lanyard.

3 removes the tampion and provides rammer, tub of water and bell rope.

G.L. looks through the bore, sees it clear and reports "bore clear".

2 closes breech, holds lock over to the right, then slams lock to the left. Lock should remain at full cock. If so he reports "lock correct" (In some guns the lock moves up and down, not horizontally).

Loading numbers see the portable magazine (if supplied) ready for use andfull.

S.S. runs the sights through the full limits of range and deflection to see that they work correctly.

When the G.L. is satisfied that all is correct, he reports "Gun cast loose".

The gun is now in the "clearedaaway" position.

ACTION.

On sighting the enemy the order "action" is given. The gun's crew immediately proceed to their gun and supply parties to their stations.

2 opens the breech

G.L. sees and peport "bore clear" and orders "Load"
5 and 7 provide projectiles.
6 and 8 provide cartridges in Clarkson's cases from portable magazine(when firing, cartridges are supplied from portable magazine until it is empty then from permanent magazine).
5 enters a projectile and assists 3 to ram home.
3 withdraws the rammer and places it against the shot guide under the breech screw, to prevent 2 closing the breech until 5 is clear after entering the cartridge.
6 unbuttons lid of Clarkson's case and tips cartridge into five's arms, who enters it into the gun.
8 passes full Clarkson's case to 6, return the empty one and provides an other full one.
2 closes the breech, enters a tube just before the lock starts to move across, and keeping the B.M. lever withdrawn sufficiently to prevent the striker going forward, reports "half cock" while in this position he will retain his hand on the B.M. lever. This is known as the "check" position.

BEARING AND OBJECT.

The Control Officer tells the G.L. and the T. the bearing and nature of target, and the gun is laid and trained on it.

RANGE AND DEFLECTION.

The Control Officer estimates the range and deflection and directs the sightsetter, who adjusts the sights and repcrts "sights set".

CONTROL

The Control Officer gives this order, which tells the G.L. that the orders to fire will be givem by the Control Officer.

2 closes the B.M. lever and stepping clear reports "ready".

G.L. stands by to fire, and the gun's crew to reload.

FIRE

When ordered to open fire by the master, or as previously arranged, the Control Officer orders"Fire" G.L. fires when his sights are on the target, and the gun is reloaded as follows:-

2 opens the breech, ejects the tube.
3 souses the mushroom head with the combined sponge and rammer.
2 holding breech open with his left hand, inserts the vent clearer, pushing it in as far as he can and gives it a twist.
7 enters a projectile and assists 3 to ram home.
3 withdraws the rammer and places it under the breech screw as before.
2 withdraws the vent clearer.
7 receives a cartridge from 6 and enters it, then provides another projectile.
2 closes the breech, withdraws the B.M. lever, inserts a tube, closes the B.M. lver and reports "Ready" as before.
5 and 7 continue to load the gun alternately as it is fired.
8 and 6 supplied with full Clarkson's cases, placing them on 6's shoulders and removes the empty cases which 6 throws aside.

NOTE.-- If there is no control officer, the G.L. carries out his duties as well as those of G.L.

NOTES ON LOADING.--(a) In the normal rate of fire time does not permit the vent clearer being used after each round; it should, however, be used whenever possible without delaying the firing, and always during a lull in the firing, and on ceasing fire residue collecting at the front end of the tube chamber will, unless removed by the vent clearer will from time to time, prevent the tube being pushed home past the retainer.

(b) The cartridges are to be kept in the Clarkson's cases until required for loading the gun, and care must be taken to keep the cartridges, especially their powder igniters, dry before loading, as if wet hang-fires may be caused.

(c) The lid of the Clarkson case is not to be unbuttoned except as laid down in the drill.

(d) No. 6 remains in the same position relative to the gun throughout the firing. It is only necessary for 6 to move sufficiently to tip out the cartridge so that it will fall as most convenient for 5 (or 7) to catch. He may unbutton the case as soon as he receives it from 8, but he is not to open the lid until 5 (or 7) is ready for the cartridge, after ramming home.
(e) No. 3 must take particular care that no burning residue is left in the gun or on the mushroom head and that no water gets into the vent. On the rammer being withdran it is to be thoroughly swilled in the water.
(f) Whenever there is a lull in the firing, opportun/ity is to be taken to souse thoroughly the mushroom head and pad with water. After the sousing, the vent clearer should be passed through the vent before inserting a tube to ensure that no water has collected in it.
(g) Should the breech jam, 2 calls out"sticky pad" 8 then puts the bell rope on the B.M. lever and assists 2 and 3 to open the breech.
(h) The greatest care is to be taken to prevent tubes being jammed when closing the breech. In nearly all cases a jam is caused by the tube not being pushed home past the retainer, and thus preventing the lock from going home.
(i) If H.E. shells are being fired, the loading number removes the loading cap and reports "cap off" Should he have difficulty in removing them he should load with the cap on the shell rather than delay the loading.

SPOTTING CORRECTION

The control officer gives the spotting correction. S.S. repeats it, sets sight and repirts "sights set" the firing is continued.
NOTE.--After a spotting correction has been given, the G.L. must not press his trigger again until S.S. has repirted his sights set.

CHECK

The control officer may give this order at any time during the firing. It stops the firing temporarily but gun and crew are ready to reopen fire instantly

2 brings the gun to check position and reports "half cock" If the gun is empty it is reloaded and brought to the check position.

G.L. and T. may reast their eyes, keeping the gun roughly on the target, G.L. removing his hand from the trigger.

The gun is brought to the ready position again by the order "Control"

INDEPENDENT

The control officer gives this order. It means that the G.L. is to lay and fire the gun as rapidly as it can be reloaded without further orders from the control officer.

Spotting corrections may be given by the control officer during Independent.

Should the control officer again wish to regulate the rate of fire he orders Control.

CEASE FIRING?

If the gun has just been fired it is left empty if the gun has not been fired;--

G.L. removes his hand from the trigger and orders "Out tube, out charge"

2 opens the breech and extracts the tube.

3 withdraws the charge and hands it to 6 who puts it in a Clarkson's case; he then souses the mush-room head and sponges the chamber.

2 inserts vent clearer and does not remove it until 3 has finished sousing the mushroom head.

2 closes the breech.

UNLOAD

NOTE.--The service ejector is the only implement that may be used to force back a projectile from its seating. Unloading is always to be carried out in slow time, under the orders of the G.L. if the gun is loaded with a nose fused shell and the ship is not supplied with a Mk. 1* ejector (that is one with a special recess in the end to take over the fuze) The gun must be fired by the order of the master.

G.L. and T.place the gun as convenient for working the ejector: 2 opens the breech; 5 & 6 provides the ejector; G.L. orders "Enter the ejector": 5 & 6 enter the ejector and reports "Ejector entered": G.L. then orders"Force back": 5 & 6 work the ejector and forces back the projectile on to the shot guide. When the projectile is far enough to the rear, G.L. orders"Well". 3 receives the projectile and places it on the deck: G.L. orders "Withdraw the ejector": 5 & 6 withdraw and return ejector: 2 closes the breech: ammunition numbers return unused ammunition: caps and pins are to be replaced in H.E. shell, and they and all cartridges which have been supplied are to be shown to the officer before being returned. If cartridges are wet they are not to be returned to the magazine.

SECURE

On entereing harbour the gun is secured. G.L. & T. place the gun in the securing position: T. lowers housing stop: G.L. and T. unship telescopes T. returning both to their boxes: S.S. runs sights to 1,000 yards range and Zero deflection.: 2 stows away vent clearer, tubes etc.: and eases springs of percussion locks: 3 replaces tampion and returns rammer and tub of water: 5 and 6 put on securing chains: 6 and 8 return all ammunition from the portable magazine to the main magazine: All numbers replace the gear they cleared away when casting loose. G.L., when satisfied that every thing is secured, will fall out the guns crew, who may then be dismissed.

MISSFIRES

The following drill will be carried out at all B.L. guns:-

Should the gun fail to fire, G.L. removes his finger from the trigger and orders "Still" reports missfire and then orders "Carry on"

2 sees the gun run out, and ensures the B.M. lever being properly closed by tapping it, and reports "Breech closed, gun out", in addition he reports if the striker has gone forward or not.

The procedure is as follows:-

If striker has gone forward

G.L. Orders "Recock"

3 recocks by pulling out the withdrawing sleeve.

2 reports ready.
The firing is continued

If striker has not gone forward

G.L. orders "Fire" by lanyard.
2 hooks on the firing lanyard. passes it to G.L. and reports "Ready"
The firng is continued.

note;(a) At guns where it is not possible for G.L. himself to fire by lanyard 2 will will fire by order of G.L.(b)When G.L. (or 2) has fired, or reports a missfire, he will drop the lanyard and 2 will unhook it.(c) The check position is gun loaded, tube indertted, breech closed and lanysrd unhooked.

2nd MISSFIRE.

Should the gun still missfire the same procedure will be carried out by G.L. and 2.

If the reports are satisfactorily, G.L. orders "shift tube". 2 orders "ammunition before the breech" "Stand clear of the vent" and extracts tube as follows:

In 6", Mk.XI, 4", Mk VII, VIII and IX.

2 cocks the striker and extracts the tube by pulling on the link guide bolt and withdrawing sleeve and moving the lock over to the right.

In 6" Mk. VII.

2 cocks the striker and extracts the tube by pulling out on the B.M. lever and link guide bolts and forcing the lock down.

3 immediately examines the tube and reports whether it has been fired or not.

If tube has been fired.

Vent is at once makked and 30 minutes must elapse before the breech is opened.

If tube has not been fired.

2 inserts a fresh tube, maskstthe vent, reports, "Ready" and the firing is continued.

3rd MISSFIRE.

Should the gun still missfire, the same procedure is carried out by the G.L. and 2.

If the reports are satisfactory G.L. orders "shift lock".

2 shifts lock.

The lock is unshipped as follows:-

6" MK. XI, 4", MK. VII, VIII and IX.

2 moves the lock over to the right as in "Shift tube", turns the locks and box-slide upwards and removes the lock.

6" Mk VII.

The lock can be unshipped with the breech closed by unscrewing on the link guide bush.

To ship the spare lock:-

4", MkVII, VIII and IX.

2 inserts lock into box-slide by pulling out. on withdrawing sleeve, and pushing lock towards the vent until link guide bolt is in line with its groove in the carrier.

2 then pulls out on link guide bolt, turns lock and box-slide down until guide bolt engages.

6", Mk XI.

As above, in addition 2 sees retracting lever forward.

6", Mk.VII.

2 ships the lock far enough for the link guide bolt to engage. Of the gun fails to fire and it has been definitely ascertained that no tube has been fired duting this and the proceeding missfire, it is safe to open the breech and examine the firing mechanism.

DRILL FOR Q.F. GUNS WITH SWINGING BREECH BLOCKS.-- The following drill is for use at a 4.7" Q.F. gun. It is also applicable to a 12 Pdr. 12 Cwt. gun when engaging a low angle target.

CLOSING UP.

Positions of the guns crew when closed up:-

At the elevating wheel	;; ..	1, gunlayer (G.L.)
On right, in line with the breech, facing the muzzle	..	2, breechworker and in charge of loading.

In rear of 1, facing the muzzle .. 3, projectile loader.
At the training wheel .. 4, trainer (T)
In rear of 3, facing muzzle .. 5, cartridge loader.
Facing the sights .. 6, sightsetter(SS)

CAST LOOSE.

On going to sea, the gun will be cast loose.
All numbers clear away obstructions in the way of working the gun.
3 and 5 remove securing chains.
G.L. and T. move the gun to see if all is clear.
T. provides telescopes and gives one to G.L.; Both then ship, focus and adjust the power of telescopes.
G.L. examines firing gear.
2 opens the breech, provides the hand extractor and belt containing percussion tubes for 5, and examines striker.
3 removes the tampion.
3 and 5 see the portable magazine (if supplied) ready for use, and full.
S.S. runs the sights through full limits of range and deflection to see if they work correctly.
G.L. looks through the bore sees it clear and reports "bore clear".
2 closes the breech.
When the G.L. is satisfied that all is correct he reports " gun cast loose",
The gun is now in the "Bleared away poisition".

ACTION.

On sighting the enemy the order "Action" is given.
The gun's crew immediately proceed to their gun and supply parties to their stations.
2 opens the breech.
G.L. sees and report bore clear and orders "load"
2 cocks the striker.
3 and 5 immediately provide one complete round. of ammunition.
3 enters the projectile, taking care to ram it hard home, especially at high angle of elevation.

He then provides an other projectile.
5 enters a cartridge, placing a percussion tube in it before doing so, and then provides an other cartridge.
2 closes the breech, but keeps the B.M. lever sufficiently withdrawn to prevent the striker going forward; he reports"half-cock".
This is known as the "Check" position.

BEARING AND OBJECT.

The Control Officer tells the G.L. and T. the bearing and nature of target, and the gun is laid and trained on it.

RANGE AND DEFLECTION.

The Control Officer gives this order, which tells the G.L. that the orders to fire will be given by the Control Officer.

2 closes the B.M. lever, and stepping clear, reports "ready".

G.L. stands by to fire, and the gun's crew to reload.

FIRE

When ordered to open fire by the master, or as previously arranged, the Control Officer Orders "Fire".

G.L. fires when his sights are on the target.

2 opens the breech and extracts the empty cylinder gun is reloaded as before.

2 reports "Ready".

Note 1.--2 sees that the firing hole bush is clear by passing his finger over it between each round while the breech is opened.

Note 2.-- If H.E. shells are being fired, No.3 removes the pin and cap, and reports "cap off" should he have difficulty in removing them, he will load with the cap on the shell rather than delay the loading.

SPOTTING CORRECTIONS.

The Control Officer gives the spotting corrections. S.S. repeats it, sets sights and reports "Sightsset"".

The firing is continued.

Note.- After a spotting correction has been given the G.L. must not press his trigger until S.S. has reported his sights set.

CHECK

The control officer may give this order at any time during the firing: it stops the firing temporarily, but gun and crew are ready to re-open fire instantly.

2 brings the gun to the check position and reports "Half cock".

If the gun is empty, it is reloaded and brought to the check position.

G.L. and T. may rest their eyes, keeping the gun roughly on the target, G.L. removing his hand from the trigger.

The gun is brought to the ready position again by the order "Control".

INDEPENDENT

The Control Officer gives this order. It means that the G.L. is to lay and fire the gun as rapidly as it can be reloaded.without further orders from the control officer.

Spotting corrections may be given by the Control Officer during independent

Should the control officer again wish to regulate the rate of fire, he orders "Control"

CEASE FIRING

If the gun has just been fired, it is left empty.

If the gun has not been fired:-

G.L. drops the firing lever and orders "Out cartridge.

2 opens the breech, extracts the cartridge and passes it to 5, and then closes the breech.

UNLOAD

Note.-- The service ejector is the only implement that may be used to force back a projectile from its seating. Unloading is always to be carried out in slow time, under the orders of the G.L.

If the gun is loaded with a noze fuzed shell and the ship is not supplied with a Mark 1* ejector (i.e., one with a special recess in the end to take over the fuze) the gun must be fired by the order of the master.

G.L. and T. place the gun as convenient as for working the ejector.

2 Opens the breech.

3 and 5 provide the ejector.

G.L. orders "Enter the ejector.

3 and 5 enter the ejector and report "Ejector entered"

G.L. orders "Force back".

3 and 5 work the ejector and force the projectile, which is received by 2, when the projectile is far enough to the rear, G.L. orders "Well"

G.L. orders "Withdraw the ejector"

3 and 5 withdraw and return the ejector.

2 closes the breech.

3 and 5 return all used ammunition.

Caps and pins are to be replaced in H.E. Sheels, and tubes removed from cartridges. H.E. shell and cartridges are to be shown to the Officer before being returned, to make sure that the safety precautions have been taken.

SECURE

On entering harbour, the gun is secured.

G.L and T. place the gun in the securing position.

3 and 5 put on securing chains.

3 replaces tampion.

2 returns hand extractor and belt od percussion tube.

G.L and T. unship telescope, T. returning both in their boxes.

S.S. runs sights to 1,000 yds. range and zero deflection

All numbers replace the gear they cleared away when casting loose.

G.L. when satisfied that everything is secured, will fall out the gun's crew, who may then be dismissed.

MISSFIRES

T The following drill will be carried out at all Q.F. guns with swinging breech mechanisms:--

Should the gun fail to fire when the firing lever is pressed, the G.L. removes his hand from the firing lever, and orders "Still", and reports a missfire and then orders "Carry Onn"

2 sees the gun run out.

and ensures the B.M. lever being properly closed by tapping it and reports "Breech closed, gun out"

He also sees and reports whether the striker has gone forward or not.

CASE 1. if the striker has gone forward:-

G.L. orders "Re-cock".

2 recocks reporting ready.

2nd MISSFIRE.

Should the gun still missfire, the same procedure will be carried out by the G.L. and 2.

If the reports are satisfactory, G.L. orders "shift striker",

2 ships spare stiker and reports "Ready".

3rd MISSFIRE

Should the gun still missfire, G.L. may order "Recock" and give it a further trial, but if there is no success, the tube is probably at fault and a pause of 30 minutes must elapse before opening the breech and shifting cartridge.

CASE 2. If the striker has not gone forward.

Gunlayer order fire by lanyard"

3 hooks on firing lanyard "ready" (at 12pdr. 12 cwt. guns it is often more convenient for the S.S. to fire by lanyard.)

When the G.L. orders "Fire" the lanyard is pulled. If this does not release the striker and it has been definitely ascertained that the stiker has not gone forward throughout the proceeding missfires it is safe to open the breech and examine the firing mechanism.

DRILL FOR Q.F. GUNS WITH SLIDING BREECHBLOCK:-- The following drills is for use at a 4" Q.F. S.A. gun in L.A. fire. It is also applicable to Q.F. H.A. gun when engaging a L.A. target except that o

(1) There is no tray so that 3 is loader instead of trayworker.

(2) Fixed ammunition is used, so that 5 and 6 are both ammunition supply instead of projectile supply and cartridge supply respectively

(3) Some 3" guns are not fitted with S.A. mechanism and can only be fired in Q.F.

x CLOSING UP

Position of the guns crew when closed up:-

At the elevating wheel .. .	1,	Gunlayer (G.L.
On right, in line with .. .	2,	Breechworker and
breech facing muzzle		in charge loading.
On left of loading tray.. .	3,	Trayworker.
facing muzzle.		
At the training wheel .. .	4,	Trainer (T)
In front of 3	5,	Projectile supply
In rear of 3	6,	Cartridge "
Facing the sights.. .. .	7,	Sightsetter (S.S.)

Note:-- At drill, 1 spare number is required to open when the gun fires, thus representing the S.A. pawl.

CAST LOOSE.

On going to sea the gun will be cast loose.
All numbers clear away obstuction in the way of working the gun.
5 and 6 remove the securing chains.
3 raises the housing stop.
G.L. and T. move the gun to see that all is clear.
T. provides telescopes and gives 1 to G.L.; both then ship, focus and adjust the power of their telescopes.
G.L. examines percussion firing gear.
2 opens the breech, sees pawl lever to S.A. and spare lock handy.
3 sees that loading tray works correctly, provides pad and firing lanyard and removes the tampion.
5 and 6 see the portable magazine ready for use and fill it.
S.S. runs the sights through full limits of range and deflection to see if they work correctly.
G.L. looks through the bore, sees it clear and then orders "Test Firing Mechanism".
2 unships and examines lock, reports "Lock correct", and replaces it. He then closes the breech, places latch to dismantle and reports "Breech closed, latch to dismantle"
G.L. presses the trigger; if mechanism,is correct, this should not release the striker.
G.L. orders" Tray forward, latch to fire".

3 pushes the tray forward, and reports "tray forward",
2 pushes the latch to fire and reports "latch to fire".
G.L. presses the trigger; this shouls not release the striker.
G.L. keeping the trigger pressed, orders "tray back".
3 withdraws the tray slowly; this should cause the striker to be released when the tray is clear of the recoil.
When the G.L. is ssatisfied that all is correct, he reports "gun cast loose".
The gun is now in the cleared away pssition.

ACTION.

On sighting the enemy the order "action" is given.
The gun's crew immediately proceed to their gun and supply parties to their stations.
2 opens the breech and hawses the B.M. lever, i. e. puts B.M. lever into the close position without pressing in on lever pinion catch. This movement puts the spring in compression, so that the breech will close when the cartridhe is inserted, as in semi-auto firing.
Note.1- Care should be taken that the lock is in place and retaining catch down before closing. the breech.
Note.2- Pins secubing firing units must be seen correctly in place before firing.
G.L. sees and reports "bore clear" and then orders "load".
5 and 6 supply one complete round on loading tray and subsequently keep tray replenished.
3 places the loading tray and, with fist clenched, forces projectile and cartridge home; the breech closes automatically.
Note.3- 3 must follow the round home and allow t he brech block to push his hand clear. there is no danger in doing so if he keeps his fists clenched.
3 withdraws the tray.
2 places the latch to dismantle and reports "half-cock". This is known as the "check" position.

BEARING AND OBJECT.

The Control Officer tells the G.L. and T. the bearing and nature of target and the gun is laid and trained on it.

RANGE AND DEFLECTION.

The Control Officer estimates the range and deflection and directs the S.S., who adjusts the sights and reports "sights set".

CONTROL

The Control Officer gives this order, which tells the G.L. that the order to fire will be given by the Control Officer.

FIRE.

When ordered to open fire bythe Master, or as previously arranges, the Control Officer orders "fire".
G.L. fires when his sights are on the target.
3 keeps the tray back, and places his right hand on junstion of projectile and cartridge to prevent their jumping out of the tray when the gun fires.
Gun is reloaded as before.
Nore 1- If H.E. shells are in use, 5 removes the pin and cap and reports "cap off". Should he have difficulty in removing them, he will load with the cap on the shell rather than delay the loading.
Note 2- Cases have occurred in which the short arm of the main spring has become fractured between parts one and two of trigger sear. This would cause sear to be released on putting catch to "fire" from "dismantle". Care should therefore be taken that on all occasions when latch is put to "fire" the gun is trained safely and 2 is clear of recoil.

SPOTTING CORRECTION.

The Control Officer gives the spotting correction S.S. repeats it, sets sights and report"sights set" Control Officers orders "Fire".
Note.- After a spotting correction has been given the G.L. must not press his trigger until S.S has reported his sights set.

CHECK.

The Control Officer may give this order at any time during the firing. It stops the firing temporarily but gun and crew are ready to re-open fire immediately.

2 brings the gun to the "check" position and reports "half cock".

If the gun is empty it is reloaded and brought to the "check" position.

G.L. and T. may rests their eyes keeping the gun roughly on the target, G.L. removing his hand from the trigger.

The gun is brought to the ready position again by the order "control".

INDENPENDENT.

The Control Officer gives this order. It means that the G.L. is to lay and fire the gun as rapidly as it can be reloaded, without further orders from the Control Officer.

Spotting corrections may be given by the Control Officer during independent.

Should the Control Officer wish again to regulate the rate of fire, he orders "control".

QUICK FIRING.

(Should the semi-auto mechanism become damaged.)

2 places the pawl lever to Q.F. and works breech.

Note. If action pawl is broken 2 opens the breech and hawses the B.M. lever.

If the breech will not close automatically, 2 opens and closes it, taking care not to keep a pressure on the B.M. lever or the extractors will not be able to go forward.

SEMI/AUTO.

2 places the pawl lever to semi-auto, and then as before.

CEASEFIRING.

If the gun has just been fired it is left empty.

G.L. removes his fingers from the trigger and orders "out cartridge".

2 opens the breech carefully.

5 and 6 remove the round from the tray.

3 receives the cartridge and places it on the tray.

2 closes the breech and eases the lock.

UNLOAD.

Note:- the Service ejector is the only implement that may be used to force back a projectile. from its seating. Unloading is always to be carried out in slow time under the orders of the G.L.

If the gun is loaded with a nose fuze shell and the ship is not supplied with a Mk. I* ejector (i.e., one with a special recess in the end to take over the fuze) the gun must be fired by the order of the Master.

G.L. and T. place the gun as convenient for working the ejector.

2 opens the breech.

5 and 6 provide the ejector.

3 places the loading tray.

G.L. orders "enter the ejector".

5 and 6 enter the ejector and report " ejcetor e entered".

G.L. then orders "force back".

5 and 6 work the ejector and force back the Projectile onto the tray.

G.L. orders "well" when the projectile is far enough to the rear.

3 receives projectile and places it on the deck.

G.L. orders " withdraw the ejector".

5 and 6 withdraw and return the ejector.

2 closes the breech and eases the spring of the lock.

5 and 6 return all unused ammunition.

Caps and pins are to be replaced in H.E. shells H.L. shell and cartridges are to be shown to the Officer before being returned.

SECURE.

On entering harbour the gun is secured.

G.L. and T. place the gun in the securing position

T. lowers the hawsing stop.

5 and 6 put on the secubing chains.

3 replaces the tampion.

2 re turns the spare lock.

G.L. and T. unship telescopes, T. returning both in their boxes.

S.S. runs sights to 1,600 yds range and zero deflection.
All numbers replace the gear they cleared away when casting loose.
G.L. when satisfied that everything is secured will fall out the guns crew, who may then may be dismissed.

MISSFIRES?

The following drill will be carried out at all Q.F. S.A. guns.
Should the gun fail to fire when the trigger is pressed, the GL removes his finger from the trigger orders "Still", reports missfire" and then orders "Carry on"
2 sees and reports "Breech closed, latch to fire"
3 sees and reports "Gun out" tray back"
If these reports are satisfactory, G.L. orders "Re-cock"
3 or G.L. recocks and judging by the effort required to work the recocking handle reports "Lock fired" or "Lock not fired".
2 reports "Ready" and the firing is continued.
NOTE.-- Even if the lock has been reported as not fired, and the other reports are satisfactory it is advisable to try again to fire again by trigger,

2nd MISSFIRE

Should the gun still missfire, the same procedure is carried out by G.L. 2 and 3.
If the reports are satisfactory, G.L. orders "Shift lock"
G.L. or 3 recocks and reports "Lock fired or Lock not fired.
IF THE REPORT is "Lock fired"
2 removes the lock, examines it and reports "Correct or not correct".
2 ships the spare lock, puts the latch to fire, reports ready and the firing is continued.
NOTE.-- If on removing the lock the firing pin is found broken, the broken piece should be removed before shipping the spare lock, otherwise a serious jam may be caused.

3rd MISSFIRE.

If, with the lock correct and firing the gun again missfires, the only remedy is to shift cartridge.

After the reports as before have been made a pause of 30 minutes is waited to allow for a possible hangfire.

G.L. (or Officer if present) then orders "Shift Cartridge.

2 opens the breech carefully.

3 removes the cartridge, examines it and reports "Cap struck or cap not struck"

If the cap has been struck, the cartridge is to be thrown overboard immediately, a new one inserted and the firing continued.

If the cap has not been struck the mechanism must be examined.

If the report after 1st and 2nd missfire is "Lock not fired."

The lock is shipped as described above, and G.L. tries again to fire.

3rd MISSFIRE.

If with the new lock, the lock again does not fire, G.L. on receipt of report from 2, orders "Fire by lanyard".

3 hooks lanyard on to trigger loop.

2 reports "Ready".

3 fires by order of G.L.

If the gun still fails to fire and it has been definitely ascertained that the lock has not fired during this and the preceding missfires, it is safe to open the breech and examine the mechanism

NOTES ON MISSFIRED GUNS.-- The danger from a missfired gun chiefly arises from the possibliity of a hangfire. If the charge is smouldering, its rate of burning may increase to explosion, causing the gun suddenly to fire. For this reason men at a missfired gun must always keep clear of recoil; if working about the breech they must do so at arms length; the gun must be trained and layed in a safe direction until the fault has benn rectified, and the breech must on no occasion be opened.

nor the B.M. lever touched until the time intervals laid down below have elapsed (therefore any tube shifting is carried out by pulling over on the lock the time interval interval will cover any possibility of a hang-fire.)
The caution "Stand clear of the Vent" when the vent is unmasked should prevent any one being struck by the tube if it is blown to the rear by pressures in the chamber generated by the slow burning of the charge. The missfire drill is the logical method of eliminating possible causes of the missfire one by one until the actual reason is discovered, but if circumstances render any short cuts to the fault obvious to the G.L. he should of course proceed to rectify the missfire at once without necessarily working through the drill as laid down.

TIMES TO BE WAITED BEFORE A MISSFIRED ROUND IS WITHDRAWN FROM A GUN, and action taken THEREAFTER.

(1) B.L. gun, wait 30 min. charge to be immediately thrown over the side.
Missfired tube to be thrown over the side.

(2) Q.F. gun, wait 30 mis. if tube or primer has been struck, charge complete is to be thrown overboard.
If tube or primer has not been struck, treat as for charge withdrawn from a Q.F. gun (see later).

PROCEDURE FOR CHARGES (NOT MISSFIRED) WITHDRAWN FROM A GUN AT "CEASE FIRE" Etc.

(1) B.L. charges are always broken up and thrown overboard, NEVER returned to magazine.

(2) Q.F. separate charges if withdrawn from a gun heated by firing are to be taken out of their cylinders broken up, thrown overboard and primers fired--the cylinders are retained. If withdrawn from a cold gun they may be returned to the magazine after examination to see if they are clean and dry in the case of Q.F. guns with swinging breech blocks, the tubes must always be removed from the charge on withdrawal.

(3) Q.F. fixed ammunition, if withdrawn from a gun heated by firing is to be fired by order of the master so as to save the cylinder or if firing is not possible the complete round is to be thrown overboard in deep water. If withdrawn from a cold gun it may be returned to the magazine after examination to see that the round is clean and dry and that the shell is not loose in the cylinder.

DRILL FOR SUPPLY PARTIES.-- The supply parties should at first be excercised separately from the guns crew They should then be drilled with the guns crew so as to co-ordinate the whole organization.

No standardized drill is laid down; the practise simply consists in supplying ammunition as fast as possible from the permanent magazine to the vicinity of the gun, shell and cartridge when these are separate being supplied in equal numbers.

The rate of supply should be regulated, in action, so that accumulations or dumps are avoided. These are dangerous, for if a dump of cordite is hit by an enemy shell it may cause fire or explosion

Where possible (at hatches, etc.)whips should be arranged to facilitate the supply.

The old charges must be kept inClarkson's cases from the time they leave the permanent magizine until they entered into the gun. As there are only a limited number of Clarkson's cases it is important that the empty ones should passed back to the magizine immediately.

Certain men should be told off to work continually in the magazine and shell room to pass out ammunition the remainder should supply the ammunition from the vicinity of the magazine to the gun. This will avoid congestion in the magazine (if one is provided) is intended for use while waiting for ammunition from the permanent magazine

AIMING PRACTICE.//Gunlayers will find that ,with any motion on the ship,it is not at all an easy matter to keep the gun accurately laid.

Aiming practise with percussion should be carried out daily for about 15 min, the gunlayer keeping the gun layed on the horizon and firing without tube or ammunition in the gun this will keep his eye in.

When carrying out aiming practise, a drill cartridge (or a drill tube in B.L. guns) should be placed in the gun and the breechworker should open and close the breech, cock the lock and report "Ready" each time the gunlayer releases the striker.

The striker should not be actually cocked and released unless there is a drill cartridge or drill tube in the gun; constsnt snapping of the striker without these may fracture the firing pin.

At some guns it may be found desirable when carrying out aiming practise to hang a projectile on the breech or put one in the loading tray to balance the gun.

In guns fitted with training gear the trainer should be excercised with the G.L. whenever an object suitable as an aiming mark presents itself.

It must be realized that the gunlayers and trainers sights are only converged for one range and at other ranges both telescopes will not be on at the same time. The G.L. should call "On" when he is on the point of aim, thus indicating to the trainer how far off the point of aim the latter should train so as to ensure the G.L. being on.

The G.L. should get into the habit of reporting good or bad shots and whether a bad shot is high, low right or left as the case may be. During actual firing this information is essential to enable the control officer to direct the fire with success.

There is an interval of about one third second between the G.L. observing the cross wires on and the projectile leaving the muzzle.

This is due mainly to the unavoidable delay in converting his intention to fire into act of firing. It is not enough that the sights should be on when he makes up his mind to fire, they must be on when the shot leaves the muzzle. It is therefore essential that the sights should be steady on the target at the moment of pressing the trigger.

SECTION 4--SIGHTING

RANGE.-- (see fig. 1.)-- In order that the shot fired from a gun may reach the target, the muzzle of the gun must be elevated as shown in Fig. 1.

T The amount of elevation necessary depends on the distance of the target from the gun. This distance is called the range of the target. The range dial of the sight is graduated in yards.

The sight is so constructed so that when the range of the target is put on the range dial and the telescope is pointed at the target, the gun is given the correct elevation to hit the target. If the target is not hit it means either that the telescope was not pointing at the target (a bad shot) or that the range on the sight is wrong.

DEFLECTION.--When a gun is fired the shot does not always travel in the direction in which the gun is pointing; it moves sideways due to the speed of the ship and it is blown a certain amount to leeward by the wind.

To hit the target it is therefore, generally necessary to point the gun a little to the right or left of the direct line between gun and target.

Also, if the enemy is moving, it is necessary to point the gun a little ahead of her; at the point where she will be when the shot falls, and not where she is when the gun fires.

The deflection points of the sight is provided to enable the gun to be pointed to the right or left of the target while the G.L. keeps his telescope pointed at the target. The amount right or left is called the deflection; and the dial is graduated in knots to make the calculation of deflection simple.

Right deflection points the gun to the right of the target, and left deflection to the left.

During fire, if the shots are falling too far to the left, a correction right will be required and vice versa.

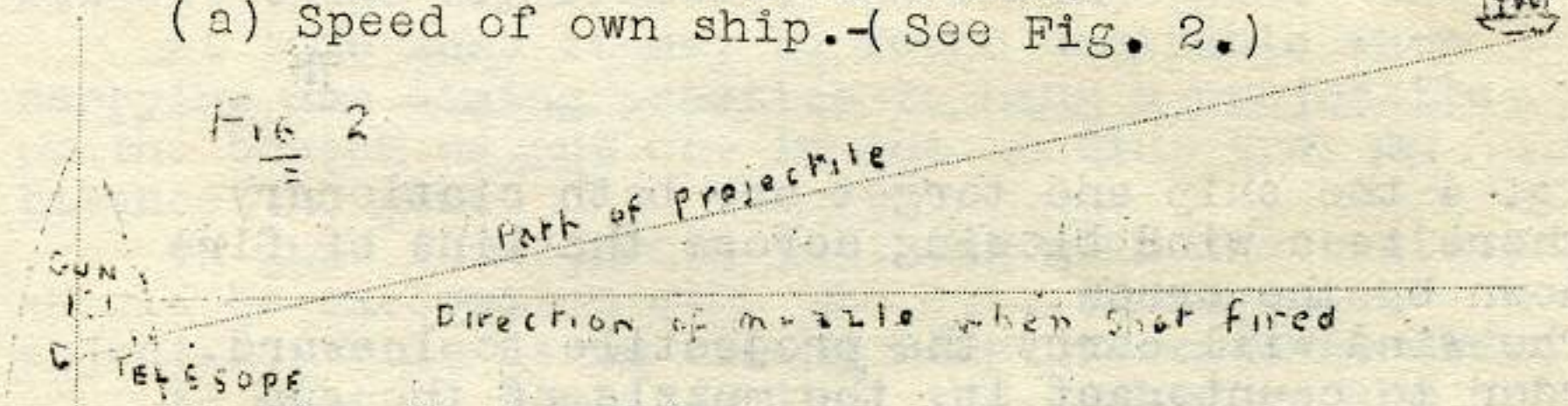
A short description is given below of the three factors which affect the deflection namely:-

(a) Speed of own ship.
(b) Speed of enemy.
(c) Wind.

Figs. 2, 3 and 4 give a view of the gun, telescope and targets as seen from above.

(a) Speed of own ship.-(See Fig. 2.)

Fig 2



In Fig. 2 the ship is steaming ahead and the target is fixed. If the gun were fired when the muzzle was pointed straight at the target.the shot would fall to the left of the target, owing to the shot retaining the sideways movement acquired from the speed of the ship. The muzzle must, therefore be pointed to the right when the gun is being fired as shown in illustration. If the target had been on the port side, the muzzle would have had to be pointed to the left. The exact angle at which it must be pointed depends on speed of the firing ship and the relative bearing to the target.

(b) Speed of target.- (Fig. 3.)

FIG 3

In Fig. 3 the ship is stationary but the enemy is moving ahead, and will move from A to B. while the shot is travelling from gun to target. The gun must therefore be pointed ahead of the enemy when fired in order to hit.

The angle in this case depends on the speed of the enemy and her course relative to the line of fire.

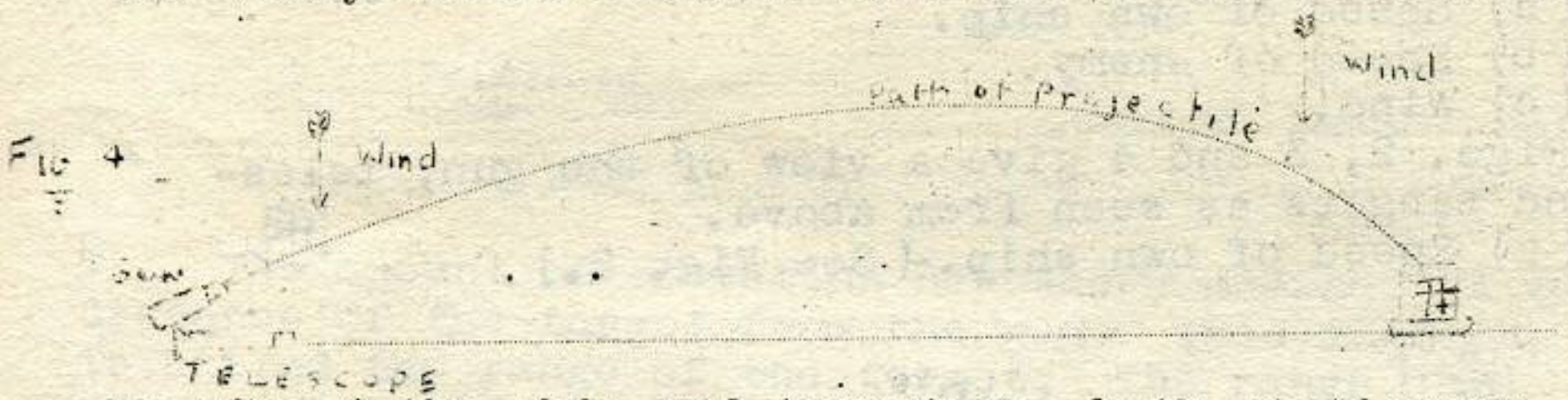


FIG 4

In Fig. 4 the ship and target are both stationary but there is a wind blowing across the line of fire as shown by the arrow.

The wind will carry the projectile to leeward. In order to counteract it, the muzzle of the gun must be pointed a certain amount to windward.

The angle in this case depends on the strength of the wind relative to the line of fire and the range of the target.

The way to combine these three factors and find the deflection which should be set on the sights is given under Section V, "Fire Control"

NOTES ON TELESCOPES.

1. They should always be stowed in their boxes when not actually shipped at the gun.
2. When shipped, always place them the same way up, and put equal pressure on the clamping screws.
3. They are only to be cleaned with the cloths provided.

4. When looking through a telescope, keep both eyes open, so reducing eye strain. Do not jamthe face against the eyepiece, as this will make the glass become cloudy.

5. Some telescopes can be adjusted for (1) focus (2) power, and some for (1) only. To focus a telescope - (a) set the telescope at the lowest power and focus until the object is clearly seen; (b) gradually increase the power until brilliance begins to decrease.

The choice of power depend on:-

(a) Brightness of day.-On a bright day a high power can be used. As the power of a telescope is increased, so the light in a telescope is diminished; consequently, on a dull day, a low power should be used, as the target will be more easily seen than with a high power.

(b) Motion of the ship.-A low power gives a larger field of view than a high power. When the ship has much motion it is necessary to have a large field of view in order to keep the target in view the whole time, consequently a low power is necessary. If the ship has little or no motion a high power can be used, as the G.L. does not need such a large field of view.

6. The cap supplied for the object glass of the telescope is seldom of use except when spray is coming over or when firing in a strong glare.

7. Illumination of telescopes.-For night work in the cases of 6" and 3" mtgs. a small lamp fed from a battery is supplied for illuminating the cross-wires. The cross wires should only be showing faintly, and to adjsut their brilliancy a small resistance box is included in the circuit

To adjust the illumination of the cross wires, first switch full on, then by turning the milled head of the resistance box, decrease the illumination until it is correct. Then take out the stop peg and screw into the next hole to the correct position of the switch; this will ensure that the light can be switched on to the correct brilliance at once.

Under normal conditions the lamp should be switched OFF as soon as the peg has been adjusted, otherwise the lamp will soon get worn out.

8. Dial Lamps.-In some cases small dial lamps fed from a battery are provided for illuminating the sight dials at night. These should only be switched on for testing at night to see that they are correct for night action. If the lamps are left burning the batteries will run down and the lamps will wear out.

OPEN SIGHTS.-In addition to telescopes, some guns are fitted with open sights. These consist of a foresight and a back sight somewhat like those of a rifle.

They should be used for getting the gun quickly on the rough bearing of the target, particularly if there is much motion on the ship. In such circumstances it is very difficult to get the gun on to the target using only the telescope owing to the field of view being restricted. It may be found necessary even to use the open sights for actual firing if the weather is bad.

At telescopes which are not fitted with illumination for the telescopes, the open sights are luminous and must therefore, be used instead of the telescopes at night.

SECTION V -- FIRE CONTROL.

ESTIMATING INITIAL RANGE.-In ships which do not have a rangefinder, and, therefore, the control officer or gunlayer must simply estimate the range to the best of his ability. Skill in estimating ranges can be improved by practice. For instance, when lying in an

open roadstead, ranges of objects such as buoys, lightships, headland etc., can be estimated and the estimated range subsequently tested by measuring the distances off the chart.

ESTIMATING INITIAL DEFLECTION.-As explained in the section on sighting, there are three things which govern the deflection, namely speed of own ship, speed of enemy and wind.

The effect of each depend not only on it magnitude but also on its direction relative to the line of fire.

The deflection to be put on the sights is a combination of the deflection due to these three factors.

In the absence of proper instruments, any attempt to calculate the deflection accurately before opening fire would cause so much delay that it is better to use a quick, rough and ready method and to rely on spotting to obtain the accurate deflection.

The diagrams which follow, furnish a quick method of obtaining an approximate deflection for opening fire.

Fig. 5. gives the combined deflection due to:-

Speed of own ship,
and speed of enemy.

Fig. 6. gives deflection due to:-

Wind.

...

FIG 6

DEFLECTION DUE TO SPEED OF OWN SHIP AND SPEED OF ENEMY SHIP COMBINED GUN

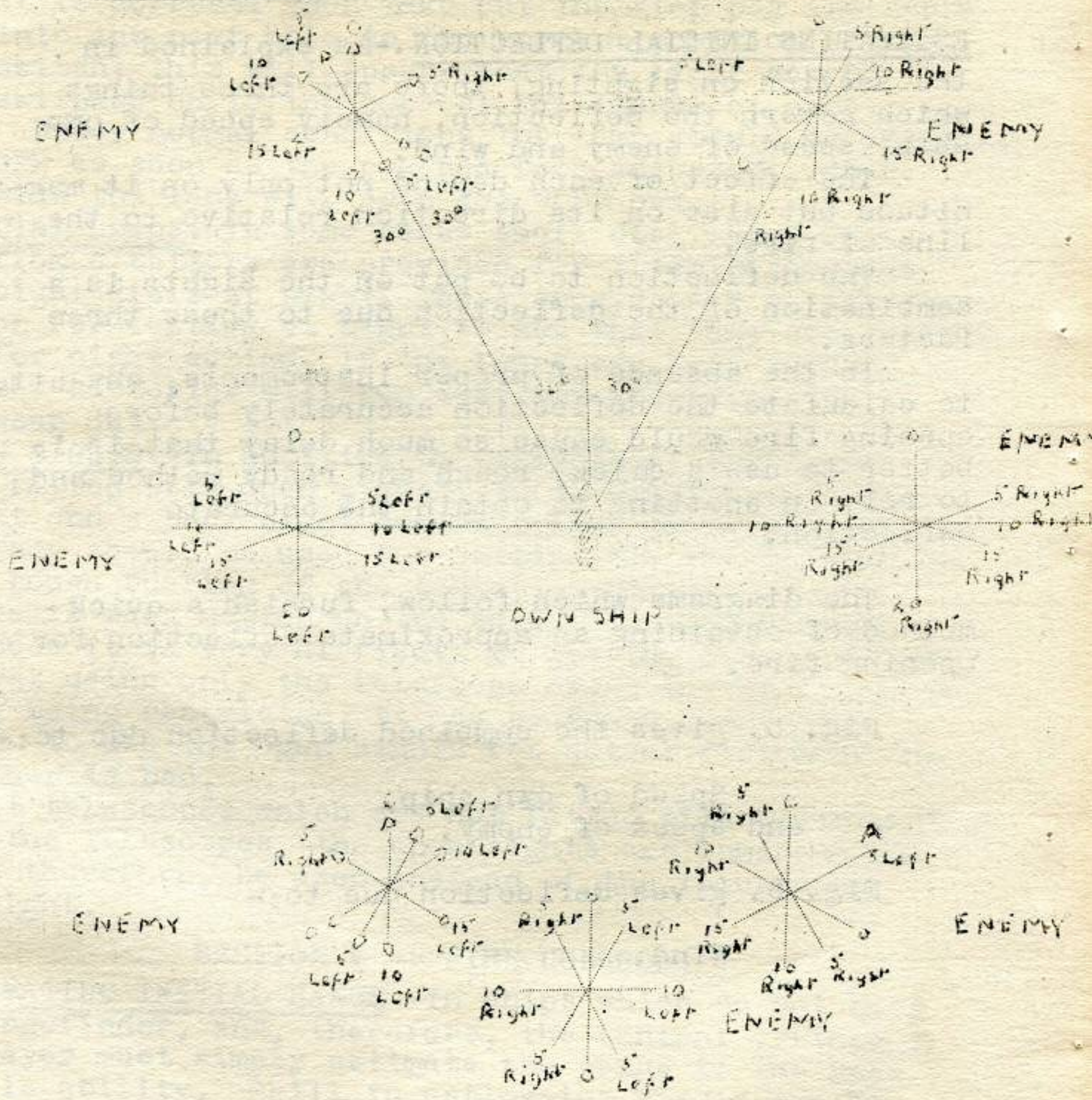
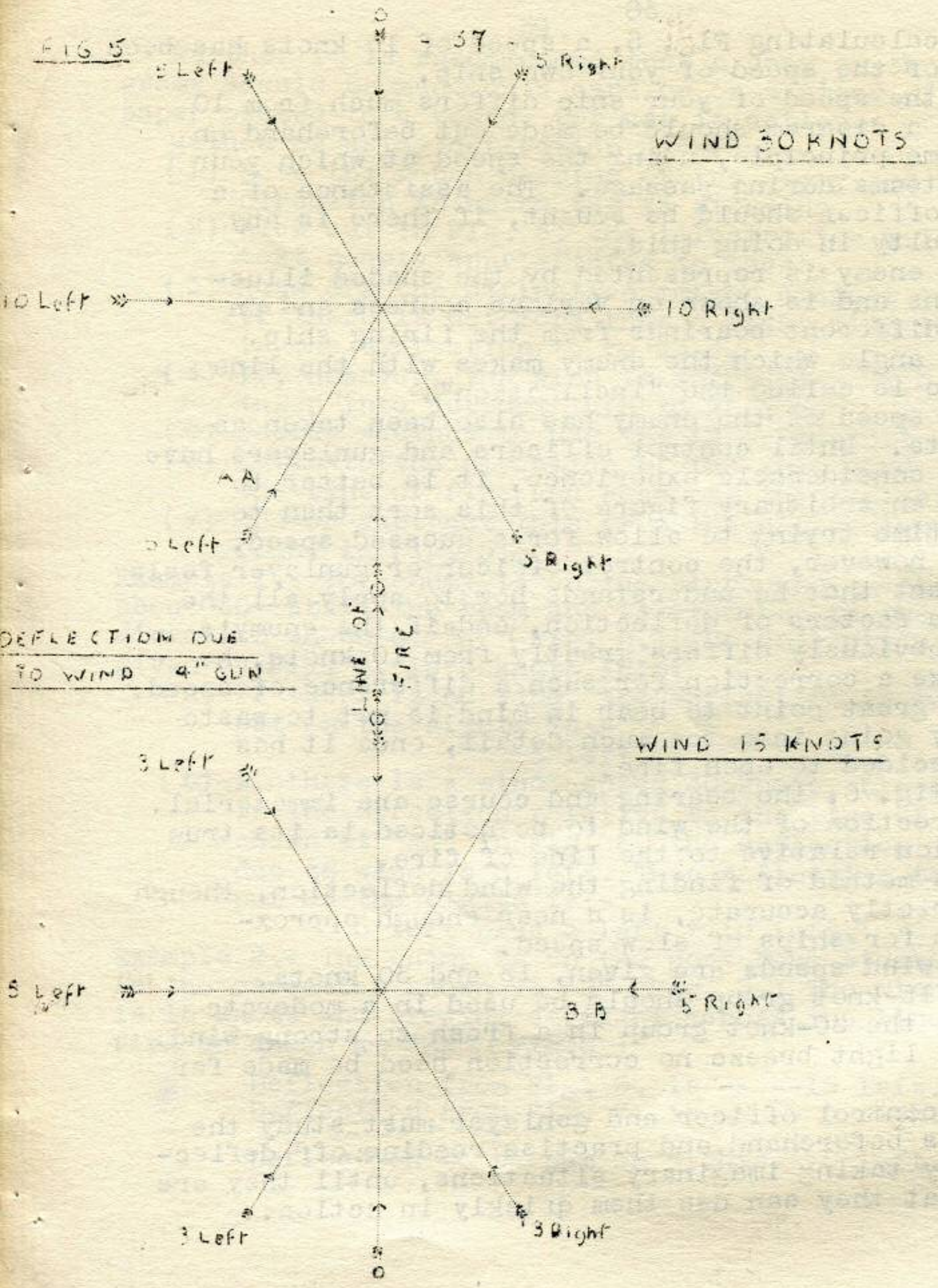


FIG 5


0
5 Left
5 Right
WIND 30 KNOTS
10 Left
10 Right
AA
5 Left
5 Right
DEFLECTION DUE
TO WIND 4" GUN
LINE OF FIRE
WIND 15 KNOTS
5 Left
BB
5 Right
3 Left
3 Right
0

In calculating Fig. 5, a speed of 10 knots has been used for the speed of your own ship.

If the speed of your ship differs much from 10 knots, a diagram should be made out beforehand on the same principle, using the speed at which your ship steams during passage. The assistance of a naval officer should be sought, if there is any difficulty in doing this.

The enemy is represented by the shaded illustrations and is shown on various courses and on seven different bearings from the firing ship.

The angle which the enemy makes with the line of fire is called the "inclination".

The speed of the enemy has also been taken as 10 knots. Until control officers and gunlayers have gained considerable experience, it is better to assume an arbitrary figure of this sort than to waste time trying to allow for a guessed speed.

If, however, the control officer or gunlayer feels confident that he understands how to apply all the various factors of deflection, and if the enemy's speed obviously differs greatly from 10 knots, he may make a correction for such a difference of speed.

The great point to bear in mind is not to waste time by going into too much detail, once it has been decided to open fire.

In Fig. 6. the bearing and course are immaterial. The direction of the wind to be noticed is its true direction relative to the line of fire.

This method of finding the wind deflection, though not strictly accurate, is a near enough approximation for ships of slow speed.

Two wind speeds are given, 15 and 30 knots.

The 15-knot group should be used in a moderate breeze, the 30-knot group in a fresh to strong wind.

In a light breeze no correction need be made for wind.

The control officer and gunlayer must study the diagrams beforehand and practise reading off deflections by taking imaginary situations, until they are sure that they can use them quickly in action.

Further it is recommended that a copy of the diagrams should be made on a card or on a piece of paper pasted to a board, for use in action.

Method of using deflection diagrams:-

(1) Note the rough bearing of the enemy and the direction in which she is steaming.
(2) Pick out in Fig. 5. the illustration which most nearly approximates to these.
(3) Read off the deflection marked against it. If there is not more than a light wind this is the deflection to be used.
(4) If, however, the wind is sufficient to be taken into account turn to Fig. 6.
(5) Decide whether to use the 15 or 30-knot group.
(6) Estimate the direction of the true wind to the line of fire and read off the deflection.
(7) Add or subtract this from the deflection found in Fig. 5.

Example 1.- The enemy is on the starboard quarter about 60° abaft the beam and is steaming in the direction shown at "A" (Fig. 5.) The deflection given by Fig. 5. is 5 knots left.

(a) If there is no wind, the deflection to be put on the sights is:-

5 left.

(b) If there is a wind, speed 30 knots, blowing in the direction relative to the line of fire shown at "AA" in Fig. 6, the deflection due to wind is 5 left. Then deflection to be put on the sights is:-

5 left plus 5 left = 10 left.

Example 2.- The enemy is on the port beam steaming in the direction shown at "B" (Fig. 5.) The wind is 15 knots and blowing straight across the line of fire as shown at "BB" (Fig.6.)

Deflection from Fig. 5. is -- --15 left.
Deflection from Fig. 6. is -- -- 5 right.

Deflection to be put on sights--10 left.

SPOTTING.-Having estimated the range and deflection as explained in the previous pages, these are put on the sights. Both will probably be in error, but it is the best that can be done to start with.

The first round is fired with these settings on the sights.

Subsequent rounds are corrected by spotting, i.e. observing the splash of the prijectile relative to the target and correcting the range and deflection accordingly.

Corrections are made on a regular system which has been formed as the result of experience. It is known as the "Bracket system", and is based on the following assumptions, which experience has proved to be unquestionably true:-

(1) When a round falls so that its splash is clear of the target to the right or left, you cannot tell whether it is over or short.

(2) The distance of a shot short or over, or the amount right or left cannot be guessed.

(3) When shots fall in line with, but over an enemy ship they may be invisible.

(4) Shots hitting an enemy ship may not be seen unless the range is very short.

Description of Bracket system.-(a) Fire a round and observe where it falls relative to the target.

(b) Make a bold correction and fire a second round.

The object of this correction is to make the second round fall on the opposite side of the target to the first.

(c) If the second round falls on the same side of as the first, repeat the bold correction. Continue doing so until two successive shots fall on the opposite sides of the target, i.e. until the target is crossed.

(d) When the target is crossed, halve the correction used for the preceding round and apply it in the opposite direction and fire again. If this round does not cross the target, apply a correction of the same size in the same direction and fire again.

(5) Whenever, and only whne, the target is crossed, halve the correction used for the preceeding round and apply it in the opposite direction and fire again. If this round does not cross the target, apply a correction of the same size in the same direction and fire again.

(6) Since the distance shots fall right or left of the target can be estimated, such rigid bracketing is not necessary for deflection provided a bold correction is made to start with so as to ensure crossing the target and so as to give a scale which can be used to assist in estimating the correct deflection. No correction of less than 2 knots should be used.

(7) Usually the deflection bracket must be fired first because as previously stated, you cannot be certain whether the splashes are over or short until you get a shot correct, or nearly correct for line. An exception must be made however, if the splashes are obviously very far over or short; in which case a large range correction should at once be made, so as to get the shots somewhere near the target before trying to get the line exactly right.

Rules for Spotting. There are several complication which affects the control of fire; some of these will be dealt with later, but the rules for the simplest case should be learnt first and used until gunlayer and control Officer have gained experience.

These rules are as follows:-

Rule 1.- Finding the deflection.- Use a bracket for deflection until shots fall in line with the target. The deflection correction on the fall of the first shot should be large to ensure the second shot falling on the other side ofthe target not less than 8 knots should be used; and if the first shot is very far wrong for direction, 16 knots may be used.

Example:-

(1) First shot falls to the left of the target and is not clearly very far short or over.

Spotting correction - right 8.

(2) If second shot still falls left, start the bracket again with a further correction of right 8

If second shot falls to right of target, deflection is known within 8 knots and the correct deflection can probably be estimated. Thus:-

Spotting corrections -- left 4.

(3) If the third shot does not fall in line with the target, the deflection will be known within 4 knots Corrections are made as follows:-

(a) Third shot falls right of target.
Spotting correction-- left 2.

(b) Third shot falls left of target.
Spotting correction-- right 2.

(4) If corrections have been accurately applied and gunlaying has been good, the fourth round should fall in line with the target and can then be seen as over or short.

Rule 2. Finding the range.-- When a shot has been observed in line with the target, as in rule 1, the range must be found by bracketing. To ensure crossing the target the first range correction should be bold. The following initial range corrections are recommended:-

Range on Gun sights	1st Range correction.
Below 2,000 yards	400 yards
2000 to 6,000 yards..	800 yards
Above 6,000 yards	2000 yards followed by 800 yards bracket.

Example:-

(1) With a range on gun sights of 1,600 yards round a is seen to fall short.

Spotting correction -- Up 400.

(2) If next shot, B, still falls short start the bracket again with a further correction of up 400 or if B appeared to be very short up 800.

If b falls over, the target has beencrossed
Spotting correction --,down 200.

(3) (a) If round C falls short the target has been crossed. Spotting correction -- up 100. Order "independent" so as to increase the rate of fire.

(b) If C falls over the target the target has not been crossed.

Spotting correction -- down 200

Wait for round D to fall.

(4) (a) If round D falls short the target has now been crodsed.

Spotting correctioh up 100.

Order "independent" so as to increase the rate of fire.

(b) If D is still over a new bracket must be begun.

Rule 3 Maintaining the Deflection. After the correct deflection has once been found, if the splashes have a tendency to leave the centre of the target, small correction should be applied at once. No corrections of less than 2 knots should, however, be necessary, except when hitting a small target, such as submarine end-on.

Note. - It will make the work of the sightsetter easier if even numbers are always used for deflection

Mainaining the Range. After having hit the target or completed the bracket as at rule 2, the only certainty that you are continuing to hit (since overs and hits may not be visible) is to see a fair proportion of shots short.

If the target is being hit, the normal errors of the gun will make about one shot in three fall short and its splash will be seen.

The rule is, therefore, as follows:-

Rule 4.-- If after finding the range by the bracket system, two successive splashes are seen short, or 3 rounds fall over or unobserved, begin a new bracket.

If the firing is rapid and the enemy is not closing or opening quickly the initial correction of the bracket may be 200 yards. Under other circumstances and if a mistake in sight setting is suspected, use a 400 yard bracket.

SOME VARIABLE FACTORS AFECTING SPOTTING. As stated on page 35, there are certain complications which affect the simple application of the rules given above. The only ones which needs to be considered are:-

Rate of change of range
Alteration of own ship or enemy.
Bad shots.

Rate of change of range :- the rate of change of range (generally called rate) is the amount which the range is altering due to the difference in course and speed between the firing ships and the enemy.

Rate is usually reckoned in yards per minute. It is called "opening" if the tange is increasing and "closing" if decreasing.

It is useful to remenber that 2 ships opening or closing each other at a relative speed of 3 knots will alter the range at a rate of 100 yards per minute.

For practical purposes the application of rate can be considered under two cases.

Case 1. When it is obvious from the strat that the range is opening or closing.

In this case the rate should be estimated and allowed for as soon as the enemy has been crossed with a spotting correction of 400 yards or less.

To estimate the amount of rate to be allowed for it is first necessary to estimate the speed of approach of the two ships, and then, knowing that 3 knots represents 100 yards per minute, to turn this into yards per minute.

In estimating speeds of approach, own ship and enemy must be considered seperately. A rough and ready means of doing this is shown in Figs. 7 and 8.

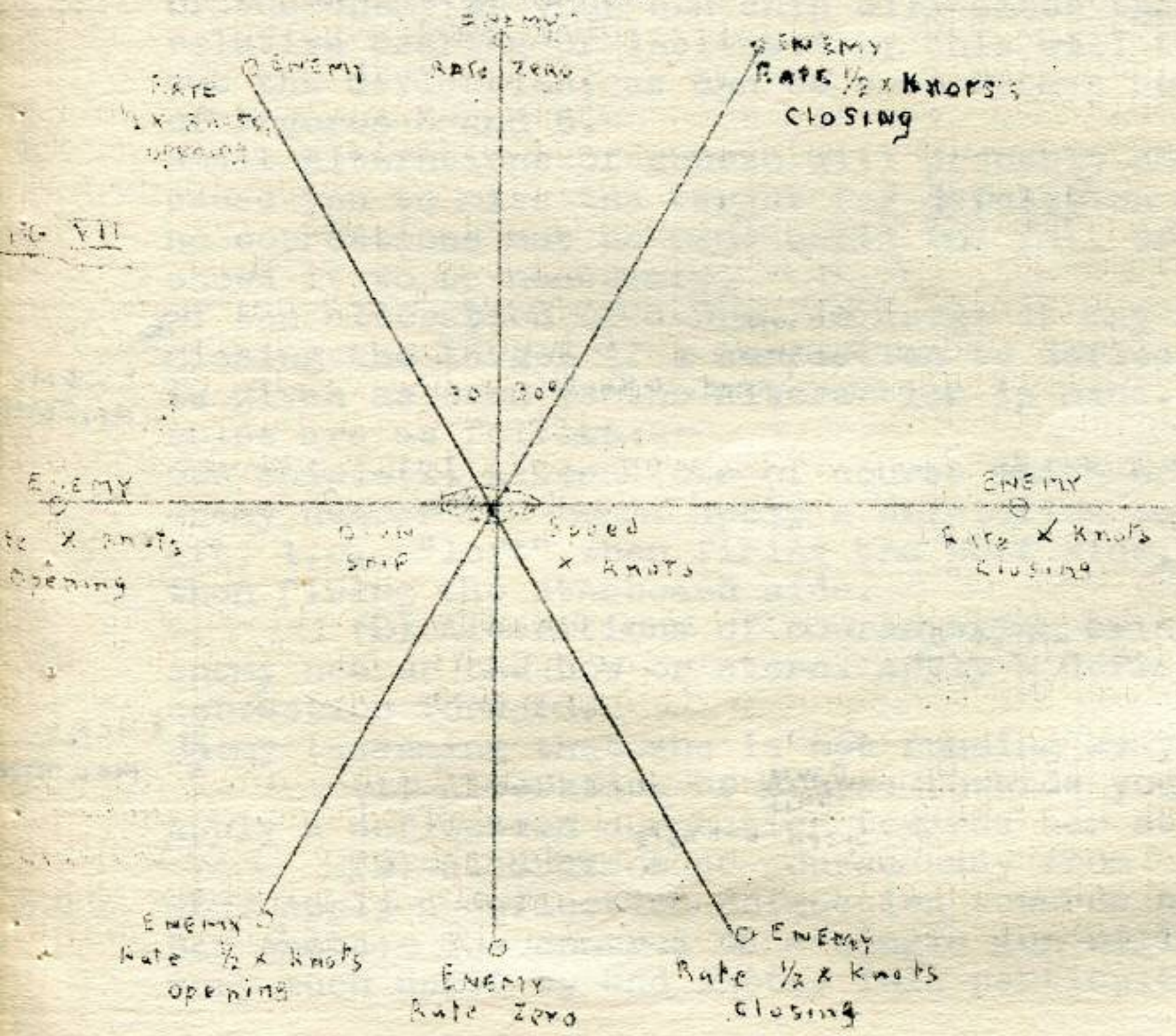
Case 2. When it cannot be ascertained for certain whether the range is opening or closing in this case no allowance is made for the rate until the bracket has been worked out to the end or a hit obtained.

If after hitting, it is definitely seen that the shots are starting to draw short or over (apart from bad shots) it is obvious that there must be an opening or closing rate.

This is probably not large, and should be assumed to be 200 yards a minute, being allowed for by spotting corrections as discribe above.

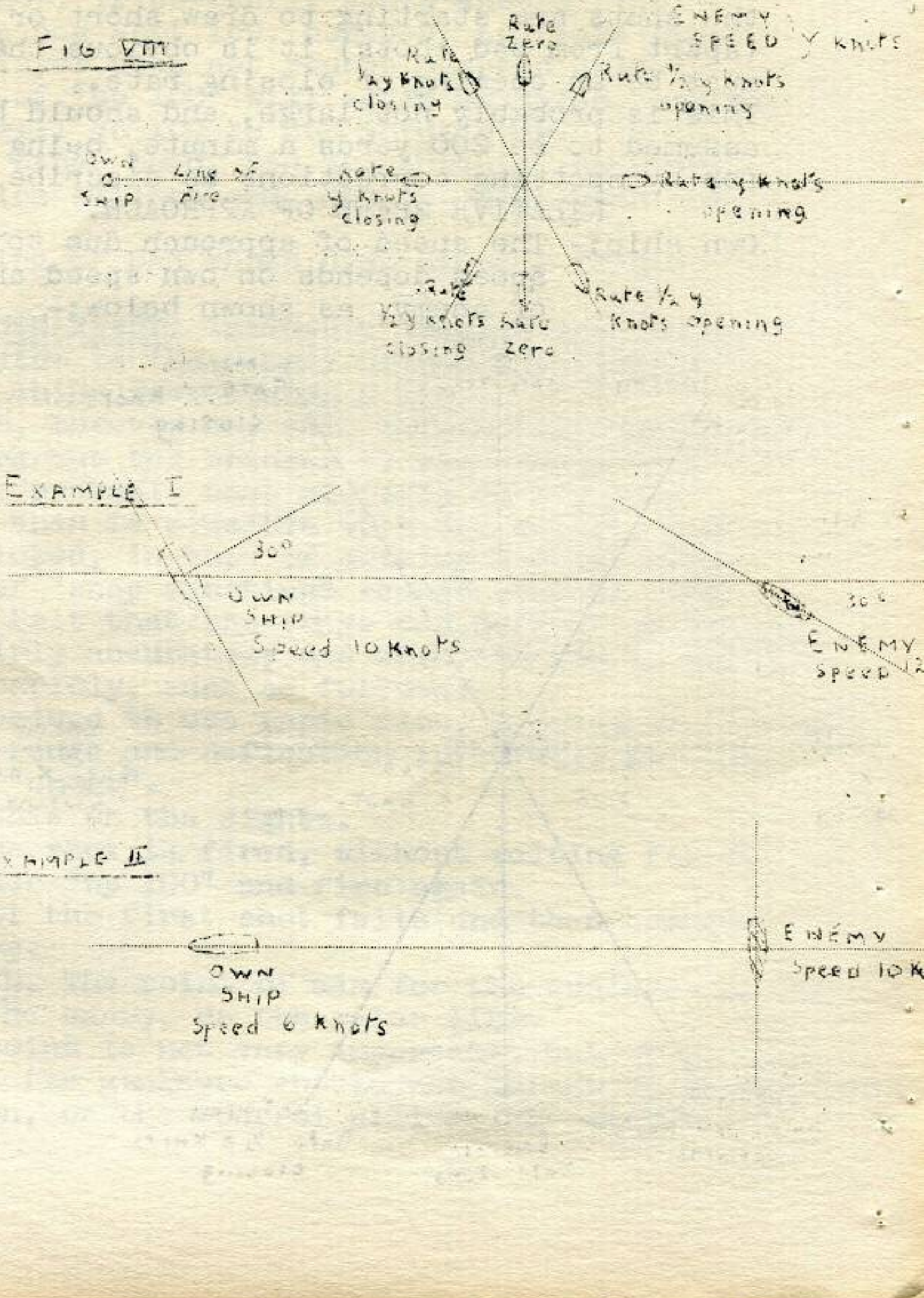
RELATIVE SPEED OF APPROACH.

Own ship:- The speed of approach due to own ships speed depends on own speed and bearing of enemy, as shown below:-



Enemy:- The speed of approach due to the enemy speed depends on the inclination of the enemy, i.e., the angle between the enemy's course and line of fire, and on enemy's speed.

FIG VIII



Having estimated the rate it is allowed for by making a correction to the range between each round, this correction being in addition to the bracket correction if working a bracket. Think of the bracket correction first, then add or substract the correction for rate.
e.g., assume that you have calculated the rate to be 400 yards a minute closing as in example 1 above, and that the gun is able to fire 4 rounds a minute. A correction of "down 100" must be made before each round.
If the calculation rate were "200 opening, as in example 2, the correction would be "up 50" between each round.
Alterations of course:- Every alteration of course of the enemy or your own ship will alter the relative bearing of inclination; this will through out the deflection, as can be seen from a study of figures 5 and 6.
Small alterations of course will probably not cause you to miss the target for defelction and no corrections may be made until the fall of shot shows it to be necessary.
If the alteration of course is large it may save missing the target if a correction to deflection is given as soon as the alterartion is made. Rough rules are as follows:-
Own ship.-(1) Alterations of course which brings enemy nearer the beam. Apply a defelction correction aft; i.e., "left" when firing the port side, "right" when firing the starboard side.
(2) Alterations of course which brings enemy nearer the bow or stern. Apply a deflection correction forward.
Ehemy (assuming that she is not running away)
(1) Alteration of course towards you. Apply a deflection correction towards her stern.
(2) Alteration of course away from you. Apply a deflection deflection towards her bows.
Bad shots:- The control of a single gun will be very much upset by bad shots. This particularly...

is the case if the gunlayer does not report when he makes a bad shot.
Example:- You are carrying out a bracket, the last correction was "down 200" and the shot falls short. You give the order "up 100" and the range is such that the shot, if correctly aimed should hit.
Owing to a bad shot low, however, it falls short. If the gunlayer does not report the bad shot a correction of "up 100" will again be given, and the next shot will go 100 to 200 yards over.
If, on the other hand, the bad shot is reported, no correction will be made and the next good shot should hit.
The reporting of bad shots also applied to deflection.
ENGAGING SUBMARINES. Against a surface vessel the bracket system is the surest method available to a single gun ship of obtaining a hit.
A submarine, however may dive before there has been time to work out the bracket to its conclusion.
If it seems probable that she will do so, more rapid fire than is possible with the bracket system may be employed, in hope of getting a lucky hit.
This type of "snap shooting" should only be used when it is felt that the range and deflection can be guessed fairly accurately and when the gun is capable of firing rapidly, such as follows:-
If it is decided to use rapid fire, proceed as follows:
Estimate a range and deflection which will put the first shot "short".
Fire with this on the sights.
Directly the shot is fired, without waiting for the splash, order "up 100" and fire again.
Repeat until the first shot falls and then correct as necessary.
POINT OF AIM. The point of aim for the gunlayer is the centre of the enemy, on the water line.
The exact point is not very important, but it is essential that the gunlayer should not change it in the middle of an action, or the control will be thrown out.

Notes on spotting the fall of shot.- The position of the splash with regard to the target must be noted at the instant the shot falls. If the control Officer waits until the column of water has reached a comfortable height before deciding this point, the wind may have drifted the spray to one side or the enemy may have moved away from the splash in the enterval, and the Control Officer will get an erronuous impression of the relative positions of the enemy and the shot, when the latter actually fell, When firing at a target moving across the line of fire it frequently appens that inexperienced control Officers think that the shot has fallen astern of the enemy;and apply a correction for deflection, when in fact the shot has fallen exactly in line. They should be watchful for this.

If the enemy passes either in front of or behind the spray thrown up by the shot, the fact should be noticed at once; as even if the shot be incorrect for line it will, in this case eneable the Control Officer to decide also if it was short or over and to give a spotting correction for range as well as line before firing again.

Remenber these rules:-

(1) Find the line first (with a deflection bracket)

(2) Locate the target for range (with a range bracket)

(3) If you lose the target, regain it at once with a further bracket.

METHOD OF COMMUNICATING RANGE, DEFLECTION, ETC.- The Control Officer must pass all his order in a clear distinct voise and in a decisive manner. His orders for setting the sights must be repeated by the sight-setter to ensure there accurate receipt.

In order further to eliminate possible chances of error the following method must be universally adopted:-

Range:- (a) Each figure in the range is called seperately, the last two figures being omitted.

(b) Three figures are always called. Should the range be less than 10,000, The figures 0 is called in front of the other two ϕ two figures omitted).

(c) Where the same figure occurs twice in succession the word "double" preceeds the figure.

(d) The figure 0 is to be called "Oh".

(e) The word yards is to be omitted.

Examples:-

One, Oh, One 10,100
Double one oh 11,000
Oh, one, oh 1,000
Oh, three, five. 3,500

Spotting orders for range.- (a) The word "up" or "down" is to preceedtthe amount.

(b) The amount of the spotting correction is to be given in ordinary language, and not in seperate figures.

(c) The word "yards" is to be omitted.

Examples:-

"Up two hundred"

Deflection.- In giving the initial deflection, each figure is to be named seperately, and the word "deflection" used.

Examples:-

10 right is called "Deflection one oh right.

22 right is called "Deflection double two right.

Spotting corrections for deflection.- To distinguish these from the initial deflection the word "right" or "Left" is to preceed the amount, and the amount is to be passed in ordinary language, not in seperate figures. This follows the procedure used in giving spotting corrections for range. The word "Deflection" should not be used when spotting.

EXAMPLE:-

"Right eight". This means "come eight knots to the right of your present deflection".

The bearing of the enemy.- This is passedto the gun with reference to the bow. Beam or quarter and on the port or starboard side.

Specimen action.- Our own ship is steaming 8 knots; an enemy is sighted, an d the control officer orders "action". At this order the guns crew and supplies parties proceed to their stations and make ready, and the gun is placed in the "check" position. The Control Officer studies the target and passes the bearing to the gun, e.g. "Submarine on port quarter."

The gun is moved until the sights are on the target. Meanwhile the control Officer estimates the range to be 7,000 yards, and the enemy to be steaming at about 12 knots on a course parellel to our own. There is no wind; and he therefore orders to the sightsetter "range oh seven oh - Deflection four right".

The sightsetter repeats these orders sets his sights accordingly, and then reports" sights set".

The Control Officer in order to let the guns crew know that he will order the firing of each shot, then orders "control". Number 2 brings the gun to the ready, reporting "ready".

The Captain having ordered that fire is to be opened, the Control Officer orders "fire" and the gunlayer fires as soon as his sights are set "on". If the Control Officer has realized that there will be a closing rate, he will allow for it as soon as he has crossed the enemy with a 400 yards corrections. His subsequent orders and proceedings might be as follows:-

No. of Shot	Range on sight	Deflection on sight	Fall of shot	Correction for Range	Correction for Deflection
1	7,000	4 Rt.	Left		Right 16
2	7,000	20 Rt.	Over Rt.	"Down two thousand"	Left 8
3	5,000	12 Rt.	Short line correct	"up eight hundred	
4	5,800	12 Rt.	Over left edge"bad shot low	Down four hundred	Right 2
5	5,400	14 Rt.	Short In line	Up one hundred	
6	5,500	14 Rt.	HIT	Independent	

Notice that the quotation "Up 100" correction after the fifth shot had fallen really consisted of an "up 200" (to halve his 400 yard bracket) combined with a down 100, (To allow for closing rate) giving a final answer of "up 100", which he ordered.

Had it been a case where it was not possible to judge whether the rate was opening or closing, the Control Officer would have waited until he had workedthe bracket out to 100 yards, and then, failing to get a hit afterwards, he would have allowed for rate as follows, for example;-

No. of shot	Range on sight	Deflection on sight	Fall of shot	Correction for range	Correction for deflection
5	5,400	14 Rt.	Short in line	Up two hundred	
6	5,600	14 Rt.	Over in line	Down one hundred	
7	5,500	14 Rt.	Over in line	No corrections	
8	5,500	14 Rt.	Over in line	Down two hundred	
9	5,300	14 Rt.	Short left edge		Right two
10	5,300	16 Rt.	HIT	Down one Hundred	

In the above example the Control Officer was justified in hoping that his seventh shot would hit, had there been no rate, and he therefore fired the 8th shot with the same range on the sight to make quiet certain. As the 8th shot also fell over and was a "good shot" the Control Officer came down 200 as first correction for rate. The next shot fell short, and the Control Officer made no alteration of range, as the enemy was running into his shots, The 10th shot was a hit and the Control Officer allowed for rate by coming down 100.

If there is little rate and the hitting range and deflection have been established, or at very short ranges, the Control Officer can order "independent" (See drill) Concluding remarks on Control). From the foregoing it will be seen that the essential factors in good shooting with a single gun are:-

(1) Good gunlaying and truthful reporting of bad shots.
(2) Quick and accurate sightsetting.
(3) Accurate observation of the fall of shot, and correct spotting corrections, promptly given.
(4) Quick and accurate loading.

The Control Officer, the Gunlayer, the Sightsetter and loading numbers form a team upon whose cooperation the quality of the shooting depends. They should therefore take every favourable opportunity of practicing together. The practices describe in Section 10 are invaluable for this purpose.

The Control Officer in action should devote his whole attention to the enemy and the fall of shot. If the crew has been properly drilled during practice he should have confidence that his orders and spotting corrections are being carried out and applied to the sights and should make no attempt to supervise the crew in addition to spotting.

DESTROYING MINES.

Keep to windward of and do not approach nearer than 100 yards to a mine when firing it. All men not engage in firing should be under cover and none should be in exposed positions.

Firing party should always wear steal helmets. Every endeavour should be made to explode mines.

Those that are sunk without exploding remain a danger to trawler fisherman.
After a mine has been sunk without exploding, do not steam over the spot until a sufficient time has elapsed for it to have reached the bottom, as a mine may explode on hitting the bottom.

Gunnery School,
3rd May 1940.
at Halifax N.S.

EXTRACTS FROM:

B.R. 219/38

NOTES ON GUNNERY

FOR

DEFENSIVELY EQUIPPED MERCHANT SHIPS.

1938

BOOK 2

SECTION - VII . THE GUN AND MOUNTING

THE GUN is a steel tube built up of several parts . Internaly it consists of the bore, extending from the muzzle to the chamber, spirally grooved or rifle . The soft copper driving band of the projectile is impressed into the rifling by the discharge , and gives the projectile it's spin. At the rear end of the bore is an enlarged part, called the chamber, for the reception of the charge. Between the chamber and the breech end of the larger guns is a part called the breech bush, which is threaded for the reception of the breech screw. The breech screw is a block of steel threaded on the circumference and mounted on a carrier, which is hinged to the breech of the gun. The breech screw can therefore be swung into the rear end of the gun, and when turned it's threads engage with those of the breech bush, thus closing the breech of the gun. In guns with sliding breech blocks the breech end of the gun is extended to the rear to form guides in which a breech block slides, slosing or unclosing to the rear end of the chamber.

The larger guns are known by the diameter of their bore in inches, e.g., 4-in.gun. The smaller guns are usually named according to the weight in pounds of the projectile they use, e.g., 12pdr.

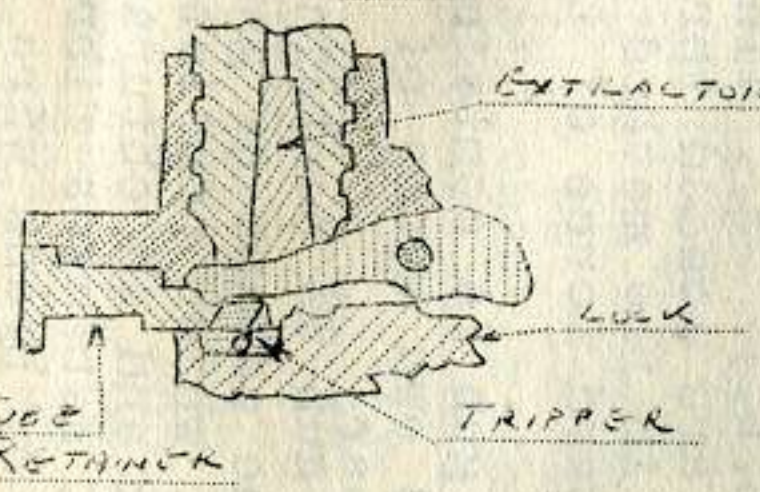
Guns are further distinguished as quick firing (Q.F.) and breech loading (B.L.) e.g., 4in. Q.F. and 4-in. B.L. Both, of course, are loaded through the breech; the difference lies in the method of sealing the breech against the backward force of the charge, when the gun is fired.

The charge for a Q.F. gun is contained in a brass cylinder, and this forms its own means of preventing the escape of gas to the rear.

The charge for a B.L. gun is contained in a silk cloth bag, and to prevent the escape of gas a mechanical arrangement is provided, which consists of a steel mushroom head and vent stalk and an obturating pad. This is a ring-shaped pad of asbestos fibre soaked in rape seed oil, and enclosed by brass wire gauze. It fits over the vent stalk, and between the

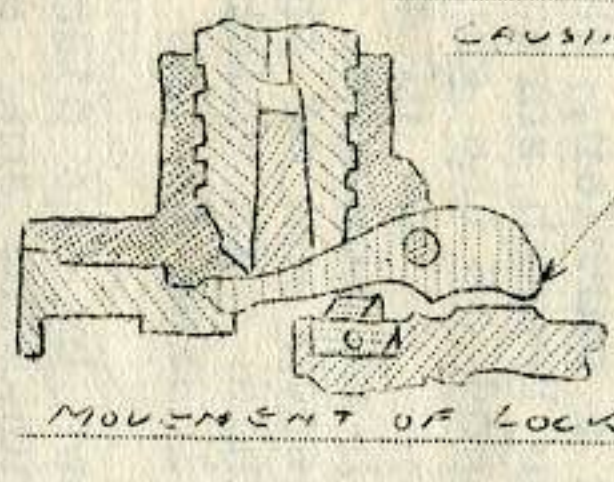
hat

TYPICAL WORKING OF LOCK & TUBE EXTRACTORS AT HAND WORKED B.L. GUNS



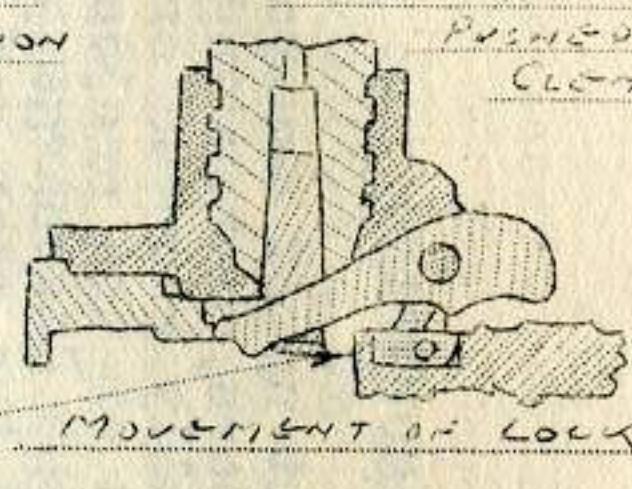
LOCK MASKING VENT

TUBE RETAINER BEHIND TUBE.



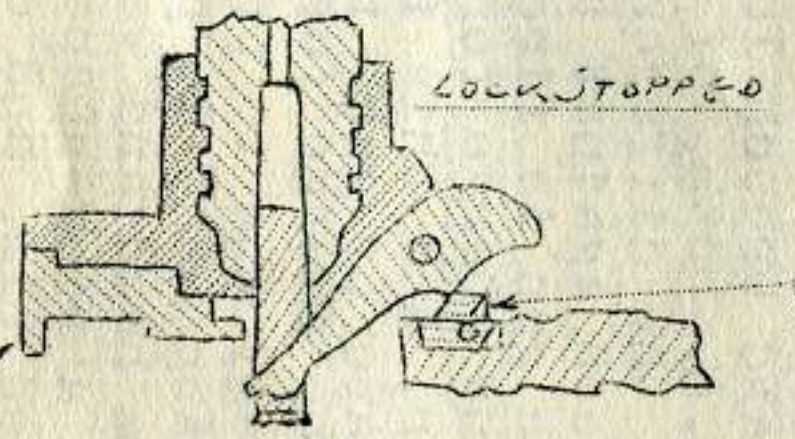
PRIMARY EXTRACTION

TUBE SLIGHTLY WITHDRAWN TO THE REAR.



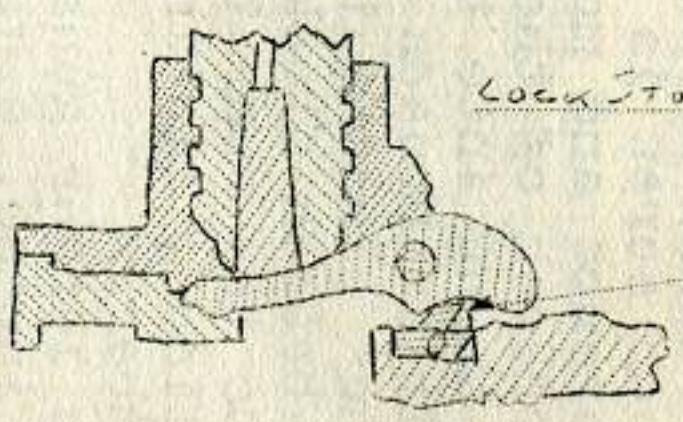
BEGINNING OF FINAL EXTRACTION.

TRIPPER IN CONTACT WITH LUG OF EXTRACTOR



END OF FINAL EXTRACTION

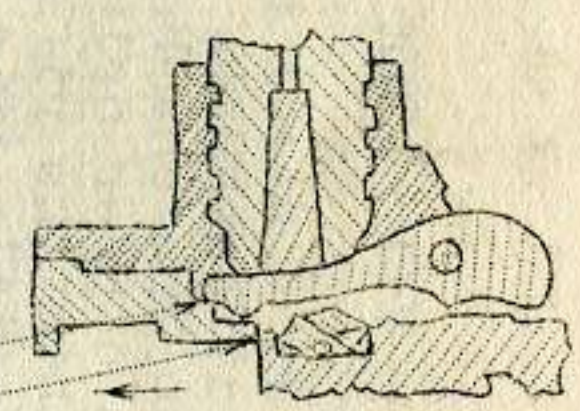
TUBE RETAINER BACK TO ORIGINAL POSITION. TUBE CLEAR. TRIPPER PAST LUG ON EXTRACTOR.



NEW TUBE INSERTED

EXTRACTOR FORWARD

LUG OF EXTRACTOR IN GROOVE SPECIALLY FITTED TO TAKE IT.



LOCK CLOSING.

TRIPPER FLAT DUE TO PASSING LUG ON EXTRACTOR

LUG REPLACES TRIPPER WHEN LOCK FULLY CLOSED.

mushroom head and the front end of the breech screw. The discharge of the gun presses the mushroom head guided by the vent stalk, back upon the obturating pad, which is thus squeezed between the mushroom head and the breech screw and caused to expand radially against the internal circumference of the chamber, thus effectually sealing the escape of gas to the rear.

Q.F. guns may be fitted with either sliding or swinging breech blocks, in the former case they allow of "semi-automatic" firing.

THE MOUNTING.-- The gun has to be capable of movement in three directions; it has to be allowed to recoil, to elevate and to train. This necessitates the mounting being composed of three distinct parts each allowing the gun its movement in one of the required directions. These component parts of the mounting are known as the cradle, the carriage and the pedestal or base.

The cradle, is the bed in which the gun lies and through which it recoils. It carries the recoil cylinders for absorbing the recoil of the gun, and run-out springs for returning the gun to the firing position, and therefore does not recoil with the gun. The gun is generally prevented from turning in the cradle by keys.

The movement of elevation is imparted to the cradle, and therefore to the gun also, from the carriage, which carries the cradle and the gun. The cradle is provided with trunions, which rest in sockets on the carriage, allowing it to swing in elevation. This movement is mechanically controlled by a pinion attached to the carriage which engages an elevating arc secured to the cradle. Movement of the elevating handwheel turns the pinion, causes the arc to move over it, and thus gives elevation or depression to the cradle and so to the gun.

.Finally the movement of training is imparted to the carriage, and so through the cradle to the gun, from the pedestal or base, which is the fixed part of the mounting and is secured to the deck. The lower part of the carriage generally forms a

pivot which pits down into a socket in the centre of the pedestdal. The pivot rests on a ball race or hardened steel studs so as to make easy training. The movment of training is mechanically controlled by a worm attached to the carriage engaging into a rack secured to the pedestal. Movement of the training handwheel rotates this worm and causes it to walk round the rack, thus turning the carriage inside the pedestal and so training the gun.

Some part of the mechanical drive for both elevation and training is generally frictional and renders if the gun receives a blow, thus preventing damage to the mechanism.

In the smaller mountings, mechanical training may be dispensed with, by easing up on the training clamp. These frees the rack from the pedestal, and allows it to be carried round with the worm. Under these conditions the gun can be moved without turning the training handwheel. A shoulder piece is provided to control the movement.

THE BREECH. -- The breech is operated by means of a lever which turns the breech screw or slides the breech block. In guns with swinging breech blocks the breech mechanism lever (B.M. lever) unsrews and withdraws the breech screw and swings it clear of the breech aperture, in one movement. In Q.F. guns with sliding breech blocks used as semi-automatic guns, the return of the gun to its firing position causes the breech to be thrown open and the empty brass cylinder to be ejected: theentry of the next cylinder into the chamber shuts the breech again automatically.

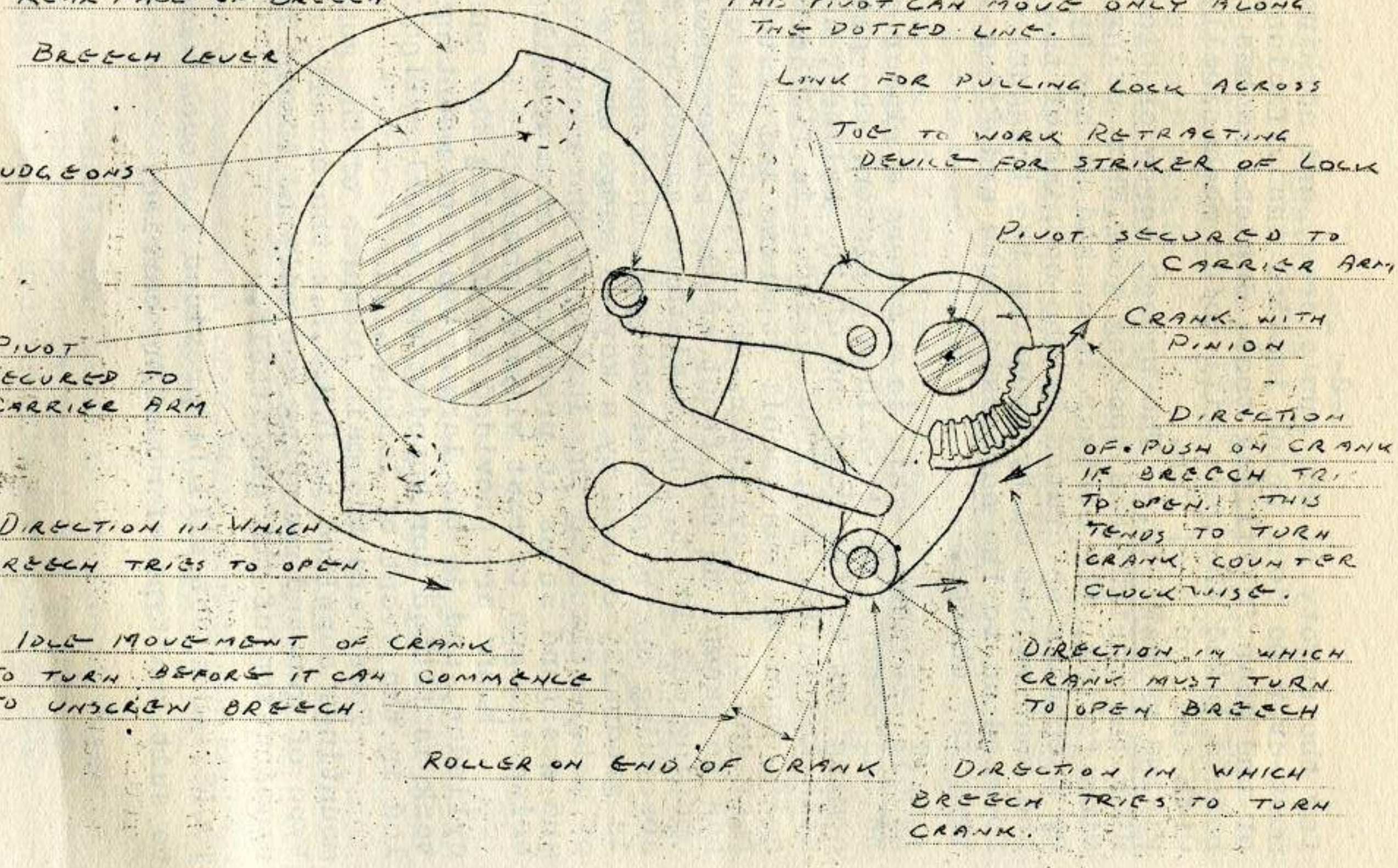
The breech and firing mechanisms of different types of guns vary considerably in detail, but they are designed to carry out three essential saftey arrangements.

(a) The breech most have no tendency to open due to the shock of the gun firing.

(b) The gun most be prevented from firing onless the breech is properly closed.

(c) The gun most be prevented from firing until it is fully run out. It will be easily understood that these arrangements are imperative

TYPICAL ARRANGEMENT OF SAFETY & IDLE MOVEMENTS AT A B.L. GUN. SHOW IN POSITION OF BREECH CLOSED.



for the safety of the gun's crew, and nothing must ever be done which impairs the officiency of the gear fulfilling those duties. As has been s tated the gear will defer mechanically with the typ e of gun.

FIRING MECHANISIM.-- The breech screw or block carries the striker and cocking gear. When using percussion firing, the striker is cocked either by hand or by mechanism op erated by the opening of the breech, and when releas ed by pressing the trigger, flies forward on to the percussion tube and fires it, and thus the charge.

RECOIL CYLINDER.--This is a strong cylinder attached to the cradle. In it slides a piston, the piston rod coming out at the rear end of the cylinder and being attached to the gun. The cylinder is filled with liquid. When the gun recoil it draws the piston to the rear end of the cylinder. The fluid in the cylinder has to escape to the front of the pistonthrough an opening cut in it, the resistance caused by this absorbing the recoil of the gun. This opening is gradually closed by a key--a wedge shaped strip of metal--fixed to the inside of the recoil cylinder and designed so as to produce an even recoil and bring the gun to rest without shock.

Means are provided for filling the recoil cylinder, and in the larger types of mountings a tank is fitted for keeping the recoil cylinder filled in the event of leakage.

These are the main features of the guns and mountings suppliod to D.E.M.S.: the details of each type of gun and mounting can only be learnt by an examination of the gun itself.

TOOLS.--One set will be provided for each vessel to suit the type of mounting carried.

SECTION VIII -- AMMUNITION

1. COMMON SHELL.--The following is a description of the various natures of projectiles that may be supplied to D.E.M.S.

Common shell are painted black and have a red band around the head of the shell. They contain a large bursting charge of powder. They have a fuze in the base (called a base percussion fuze) and explose with good blast effect.

2. High explosive (H.E.) shell are painted yellow with a red band around the head, the bursting charge beeing of some form of high explosive. They are fitted with a fuze in the noze, which is protected by a cap, secured by a pin. Both pin and cap must be removed before the projectile isloaded in the gun. They have poor penetrating quality but a most shattering effect.

3. Practice projectiles are eithermsolid cast iron or are common shell, without a fuze, with the powder filling replaced by a substitute such as salt. They are painted black with a yellow band around the body.

The following information is stencilled upon the shell :--

Gun intented for.
Mark of projectile.
Fuzed and particulars of fuze.
Monogram of filling station or
Filler's initials.
Date of filling.
Particulars of explodor.

TRANSPORT AND STOWAGE OF PROJECTILES.--

Pointed common shell of 4.7-in. and below are issued, and are to be transported in boxes. All other shell, except fuzed H.E., are supplied in bulk.

Base fuzed shell are never to be stowed "base to point," as there is a danger of the point of one projectile being driven into the fuze of the other.

DRIVING BANDS are made of copper and grip the rifling of the gun as the projectile passes down

the bore, thus giving it its spin. The driving bands should be carefully treated, because if they become dented or otherwise damaged there is a tendensy for gas to escape past the projectile, and innaccurate shooting will result.

FUZES

A fuze is the devise by means of which the bursting-charge in the shell is exploded.

The base percussion fuze is fitted in the base shell. It has a number of saftey arrangements which make the shell safe to handle, and which are thrown out of gear only by the skock of the discharge and the spin of the shell as it is fired from the gun.

The direct action impact fuze is a nose fuze and is fitted to high explosive shells. This type of fuze has not so many saftey arrangements as the base fuze, and is therefore fitted with a safety cap and saftey pin, which have to be removed before the shell is loaded into the gun.

CARTRIDGES.--The explosive used to fill all cartridges is cordite. Cordite is not immediately affected by moisture, but it suffers rapid deterioration under unfavorable conditions such as high temperature of storage, or contamination with oil and dirt. When exposed to these conditions for any length of time it is liable to spontaneous explosion.

Cordite will burn very fiercely if exposed to flame, and if any large quantity of cordite is ignited it may explode.

Cartridges for B.L. guns.--The sticks of cordite are tied in a bundle and sewn up in silk cloth for convenience in handling. At each end of the cartridge is sewn a powder igniter contained in a red shalloon bag. The igniter is lit by the flash of the tube when the gun is fired, and in its turn ignites the cordite charge. It is essential that the igniter should be kept dry when the cartridge is loaded in to the gun.

NOTE:--Igniters are sometimes fitted at one end only of the charge, in which case care is necessary to see that the charge is loaded with the igniter to the rear.

Cartridges for Q.F. guns--The sticks of cordite are contained in a brass cartridge-case which also holds a powder igniter. Cartridges for use in Q.F. guns with sliding breech blocks carry a percusion primer in the base which is struck by the stricker wgen the gun is fired, and so fires the igniter and cordite charge. These cartridges are supplied with the primer covered by a saftey cap, which must be removed before the cartridge is loaded into the gun.

Cartridges for use in Q.F. guns with swinging breech blocks carry an adapter in the base. A vent sealing tube must be inserted into the adapter before the cartridge is loaded into the gun.

Cylinders for Q.F. charges are always to be retained after the charge has been fired, re-stowed in their boxes, and returned to authorities at a base.

Fixed ammunition for Q.F Guns

For certain Q.F guns the base of the projectile is secured in the mouth of the brass cartridge case Such ammunition is to be stowed in the magazine and no attempt is to be made to separate the projectile from the cartridge. The cylinder is to be retained after the round has been fired, Re-stowed in its box and returned to authorities at a base.

CASES AND BOXES. All boxse and cases containing ammunition should be handled with care to prevent injury to their contents. Rough useage is calculated to cause missfires, hang-fires or even premature explosions, and furthermore, ammunition boxes so handled cannot be expected to retain their air and water-tightness.

Rectangular cases are used for the supply of charges for B.L. guns. They are made of sheet brass and are corrugate to give strength$\frac{3}{4}$ The lid is made watertight by luting a washer.

Q.F. ammunition boxes, in which cartridges for Q.F guns are supplied, are made of wood, lined with tin and made watertight and strengthened with battens and brass straps. The lid of the box is fastened by a frame, which engages in four metal bolts on the box itself, the frame, which engages in four metal bolts on the box itself, the frame being moved by a cam, which is worked by a metal key. A notch is made under two opposite corners of the lid, so that the handle of the key may be inserted for prising the lid open.

PERCUSSION TUBES.

Vent sealing percussion tubes.--Percussion tubes are used in all guns with swinging breech blocks to fire the powder igniter of the cartridge and thus the cartridge itself.

They are supplied in sealed tins; and it is important that they should be kept dry and on no account subjected to rough handling.

MAGAZINES.--In port the ship's permanent magazines are always to be kept locked. At sea, the key of the permanent magazine(which should remain locked) should be the responsibility of some dependable member of the supply party, and should be kept on the bridge, easily accessible.

Fire hoses should be kept rigged at all times, to reach both magazines, and buckets of sand should be stowed in the immediate vacinity.

On arrival in harbour, the ready-use stowage should be emptied and the ammunition placed in the permanent magazine.

No smoking is ever to be allowed near any magazine if filled.

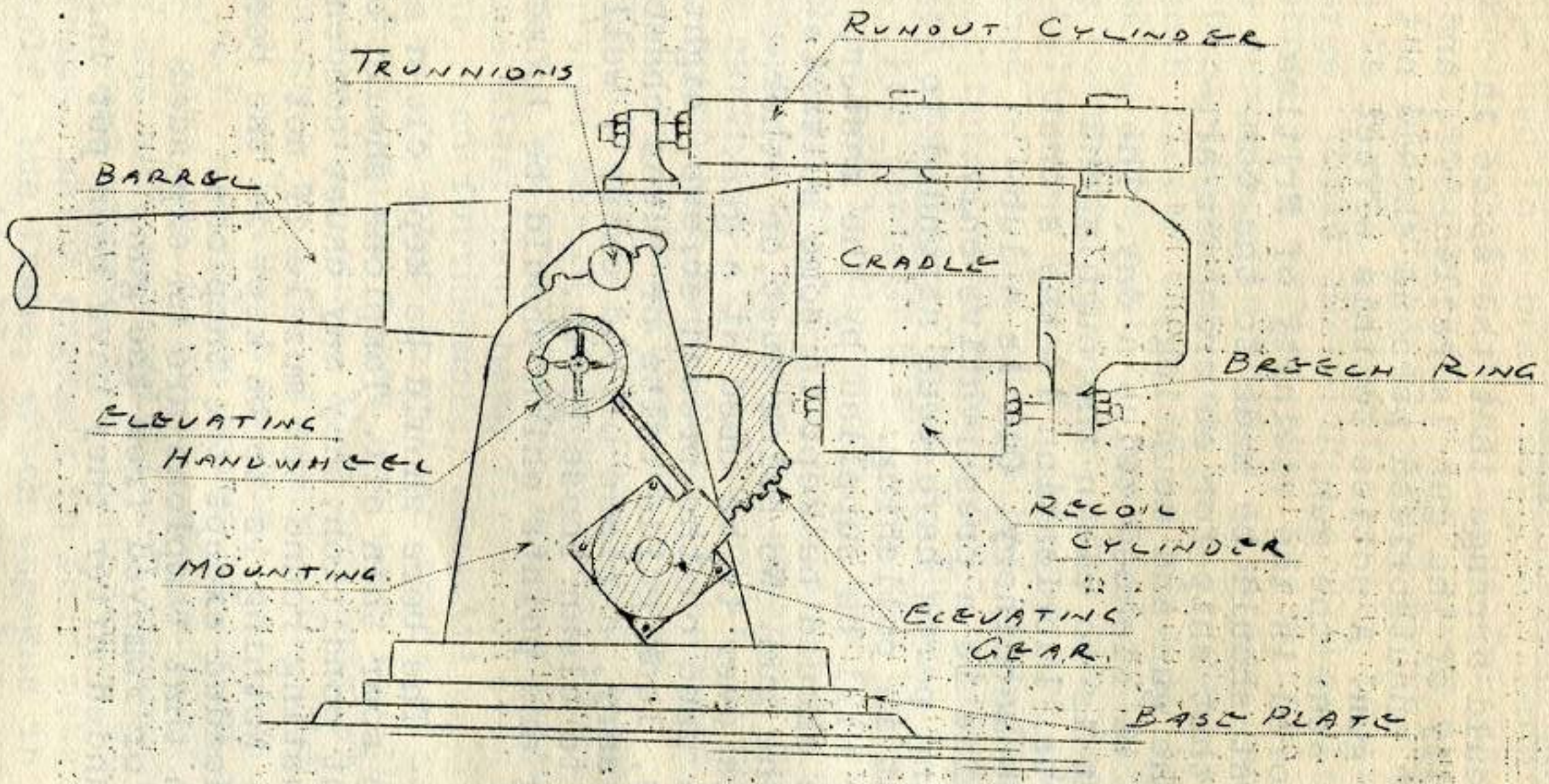
When possible, separate stowages will be fitted for charges and for charges, though these will always be adjacent.

Tubes are never to be kept with the charges. If two stowages are fitted, they may be kept with the shells, if not, special tanks will be provided for tubes only.

Gun Battory,
R.C.N. Barracks,
Halifax, Nova Scotia
20th February , 1940.

GD.

TYPICAL HANDWORKED GUN MOUNTING. (G.L.'s SIDE)



SHOWING RECOIL, RUNOUT, AND ELEVATING ARRANGEMENTS.

SECTION IX. - CARE AND MAINTENANCE.

The master should arrange that the space in the immediate vicinity of the gun is railed off, and passengers and other unauthorised persons should not be allowed near the gun. A notice to this effect should be posted up near the gun.

Whenever anchored in the vicinity of British man-of -war a request should be made to the commanding officer of that ship for an ordnance artificer to inspect the gun and mounting.

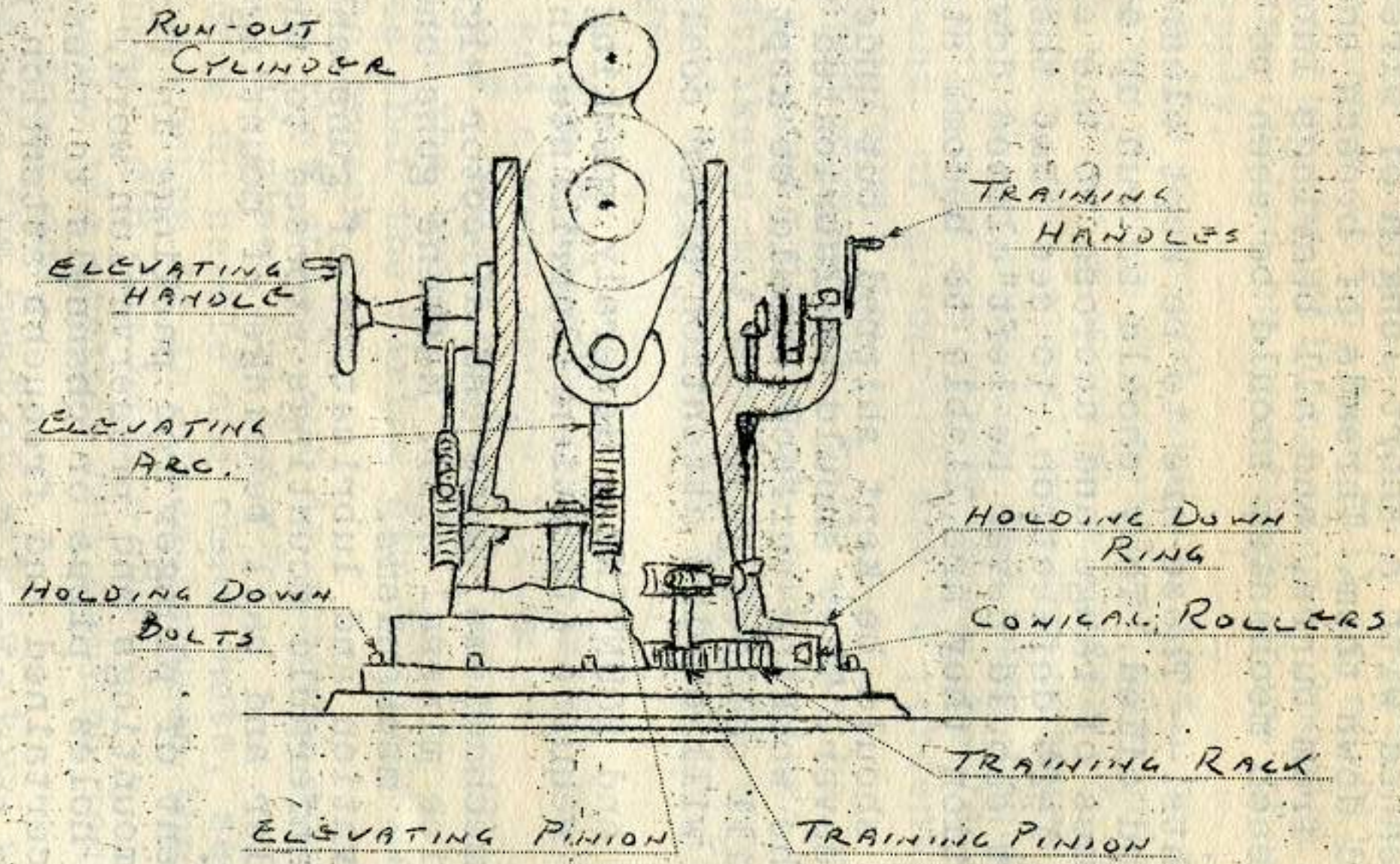
The gun is to be cleaned twice a day. The most important point is to clean thoroughly and oil all working parts. Lubrication is the secret of efficiency in gun machinery. Oil is a lubricant, while vaseline is a preservative only. Only when all working parts have been attended to should time be spent in polishing.

Cleaning gear will be supplied by the master, and when not in use should be kept in some suitable rag-tank close to the gun. No brick dust,or other gritty substance, is ever to be used at a gun. Emery should not be used on the breech screws, sights, points of strickers, lock guide bolts or tubes chamber; if absolutely necessary, a piece of old emery , well oiled, may be used to clean those parts.

The following are points which should be looked to daily:--

(1) The Gun.-- The bore should be kept clean and slightly oiled with somr thin oil. Tampions should be seen in an efficient condition;they may cause condensation which results in rusting round the muzzle if not frequently removed. Nothing is to be kept in the bores of the gun when unloaded except the tampions. Care is to be taken that tampions are un-expanded when being entered or removed from the gun; they are to be expanded after they have been put in.

TYPICAL HANDWORKED GUN MOUNTING, VIEWED FROM THE REAR. SHOWING ELEVATING & TRAINING ARRANGEMENTS.



(2) THE BREECH MECHANISM.Removal fittings should be frequently taken apart to ascertaim that they are sound, clean and well oiled, Small holes and channels, designed to allow the passage of lubricants should be cleaned with a shbrt length of wire, before oil is passed down them. Threads of breech should be seen free from burrs, and all bearings lubricated. The whole breech mechanism should be seen to be working smoothly.

(3) The Sights.-- These are to be kept clean, free from grit, and oiled. They should be run up and down to the extremes of range and accross to the extremes of right and left deflection, to see that they work smoothly, but should never be left"closed down" as in this position they are liable to become strained.

Sights should be kept shipped, but under a water-proof cover. They should be lubricated with olive oil. The working surface should be kept dry, as any oil will collect grit.

Sights willrequire attention after coaling.

(4) CRADLE and MOUNTING.- Generaly speaking the following parts require attention (lubricants in brackets):---

(a) Guns' mechamisms, guns and director sights (general service mineral oil). Machine guns and simiiliar delicate mechanisms.

(b) Preservation and lubrication of guns and (heavy torpoil) tranferable mountings exposed to the sea water also for roller and ball bearings of mountings afloat and in store.

(c) Treatment of plunger rod packings in (minerall grease) gun mountings and preservation work.

The air holes, pipes or channels to these parts should be ascertained and frequent attention paid to them, keeping them clear for the passage of the lubricant. All working parts must be seen well lubricated. Split pins should be seen to be in place.

The gun should be moved to the extremes of training and elevating, to ensure that everything works smoothly.

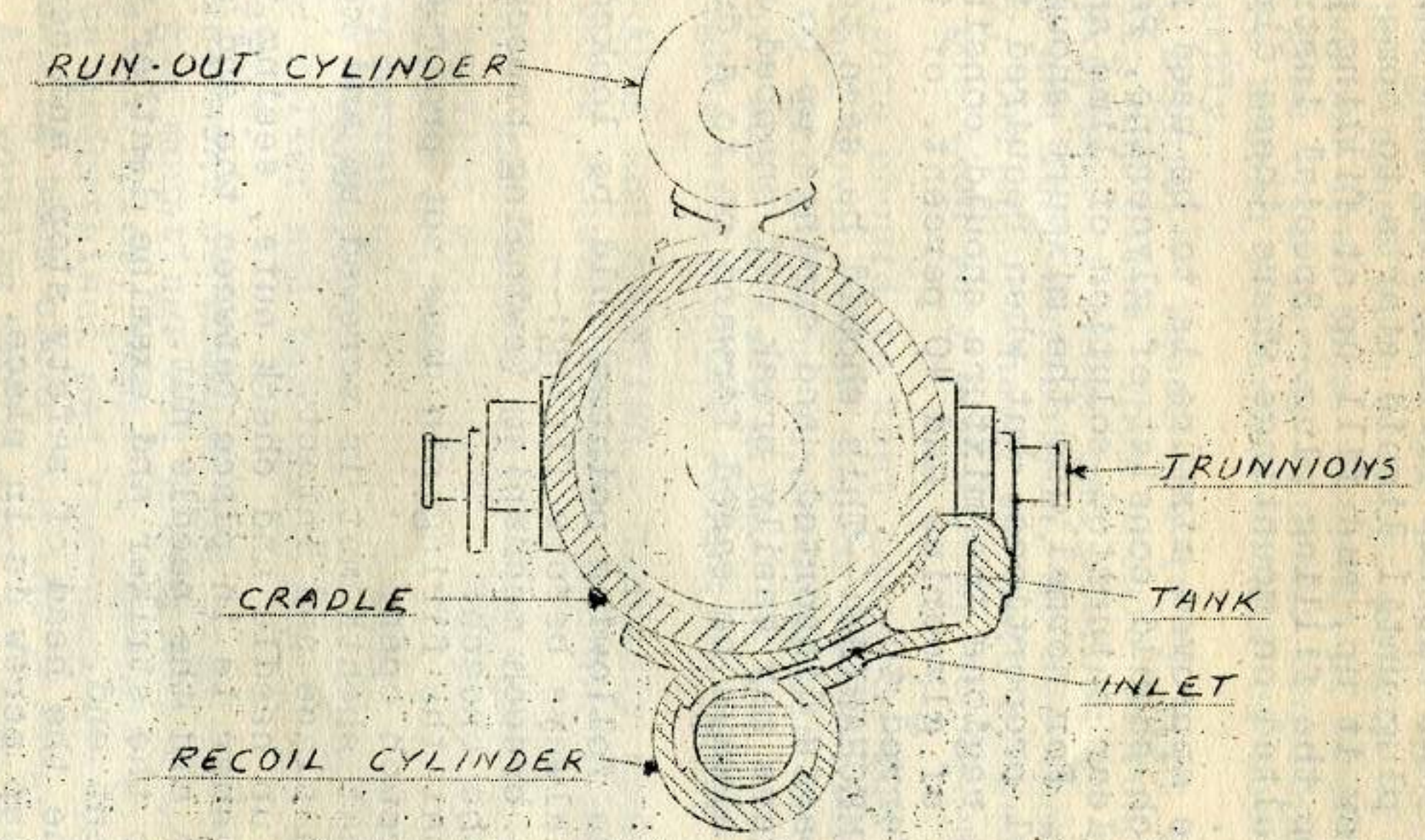
(5) RECOIL CYLINDERS:--See that these are full. To do this, after they have once been filled, the following procedure is carried out. Place the gun at depression. Take out the filling plug and ease back the air plug until liquid starts to come out of it, then screw it up, and fill up at filling plug; then screw up the filling plug. Special instruction plates are bolted on mountings where these directions do not apply.

Only the approved mixture is to be used for this purpose, which should consist of glycerine, Pattern 712, and a clear saturated solution of lime and distilled water. For normal use the mixture should be made in equal proportions, but when required for use in very cold regions the mixture should consist of 60 per cent. of glycerine and 40 percent. of the solution referred to.

(6) FIRING MECHANISM:--This should be seen to work easily; no parts distorted, and springs up to their work. Strikers may easily break off snapped forward; they should always be eased forward on to a dummy cartridge.

WEEKLY:-- The following pointsshould be looked to weekly, and always before firing:--

(1) (a) Q.F. breech mechanism (swinging breech):-
  (1) Open the breech.
  (2) See that the firing pin does not protrude with the breech open.
  (3) See that sheath nut is screwed up and keep pin in place and intact.
(4) Screw up needle and check nuts, seeing that the washer is in place between the end of the sheath and the needle nut.
(5) Unship the striker and examine leather washer at front end.
(6) Examine the head of safety stop, and see that the keep screw is in place.
(7) Remove the breech block and examine the gudgeon pin.
(8) Re-assemble breech block and ship striker
(9) Guage protrusion of firing pin.



SECTION THROUGH RECOIL CYLINDER

SHOWING POSITION OF TANK AND INLET TO CYLINDER.

(B) B.L. Brooch Mechanisims;--

(1) Remove lock,box slide, vent axial and brooch screw.

(2) Test stud or studs on rear face of screw; lightly oil stud round its junction with the flange of the screw and give it a smart tap. If cracked, a line of oil will delineate the crack.

(3) Replace brooch screw, seeing that threads on it and those of brooch opening are free from burrs

(4) Replace vent axial and fittings. See split rings are not in line. Ensure vent and tube chamber being clear and clean.

(5) Replace box slide. See tube extractor and retainer in good order. Lightly oil the guides in which the lo cks works.

(3) Replace lock, seeing trigger and rebound action (if fitted) w ork correctly. Gauge and adjust for protrusion.

(c) Q.F. brooch mechanisms with sliding breeches;

(1) Remove block complete, as follow;

Open brooch.

Withdraw split pin, nut, and actuating bolt.

Remove block complete, being careful to support the extractors.

(2) Remove and examine lock, seeing firing pin correct, and axis correct. Replace lock, putting latch to fire.

(3) Ease striker and gauge for protrusion.

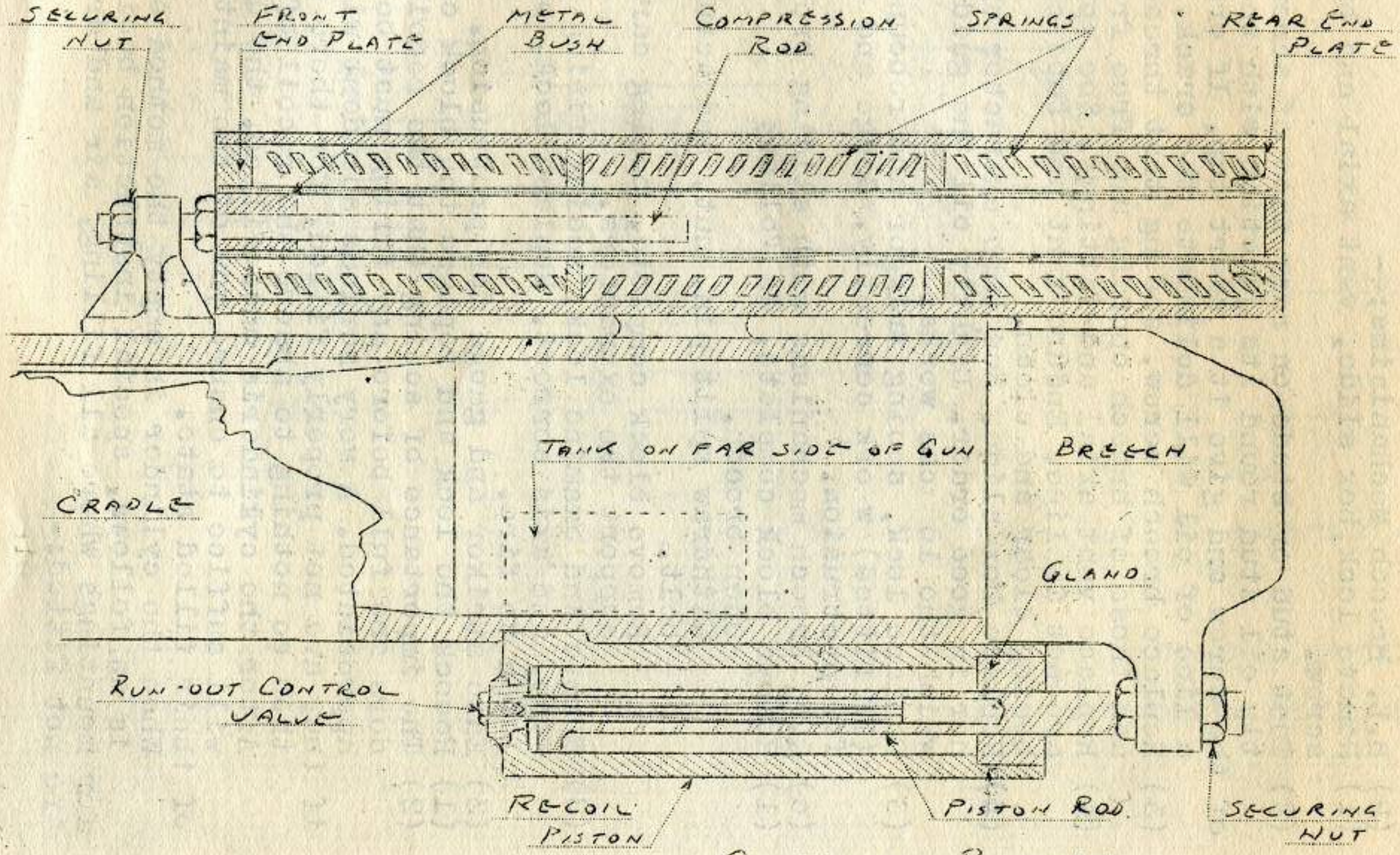
(1) Recock the lock and replace the block complete.

(2) The importance of seeing that the recoil cylinders are full before any firing must be fully appreciated. A very serious accident will occur if they are not properly filled, for there will then be nothing to absorb the recoil of the gun. After the cylinderis once filled, the daily test will suffice to ensure you of the maintainance of their filled state.

When the cylinder is empty the method of filling is as follows, special instruction being given for mountings where all filling, air and drain plugs are not fitted:-

TYPICAL ARRANGEMENT OF CRADLE. SHOWING SECTION

THROUGH RECOIL CYLINDER & RUN-OUT CYLINDER.



The recoil cylinders are filled with a mixture consisting of half water and half glycerine. The water should be a clear saturated solution of lime and distilled water, and the glycerine pattern 712. The general procedure is to give the gun full depression, then ease back the drain plug and unscrew the filling plug and air plug. Fill through the filling plug, and as soon as liquid starts to trickle out through the drain plug, screw it up tightly. Then continue filling till the liquid comes out of the air plug, then screw that up, and fill to the top of the filling plug, then screw up the filling plug.

TO GUAGE A STRIKER FOR PROTRUSION.

First ease striker forward. (1) In Q.F. guns with swinging breech blocks, this is done as follows:—

Open the breech, press in on the catch retaining breech screw open, and close the B. M. lever, at the same time holding on to the carrier to prevent the latter closing. The striker is now protruding.

(2) In B.L. guns, remove the lock and ease the striker forward by releasing the firing bar.

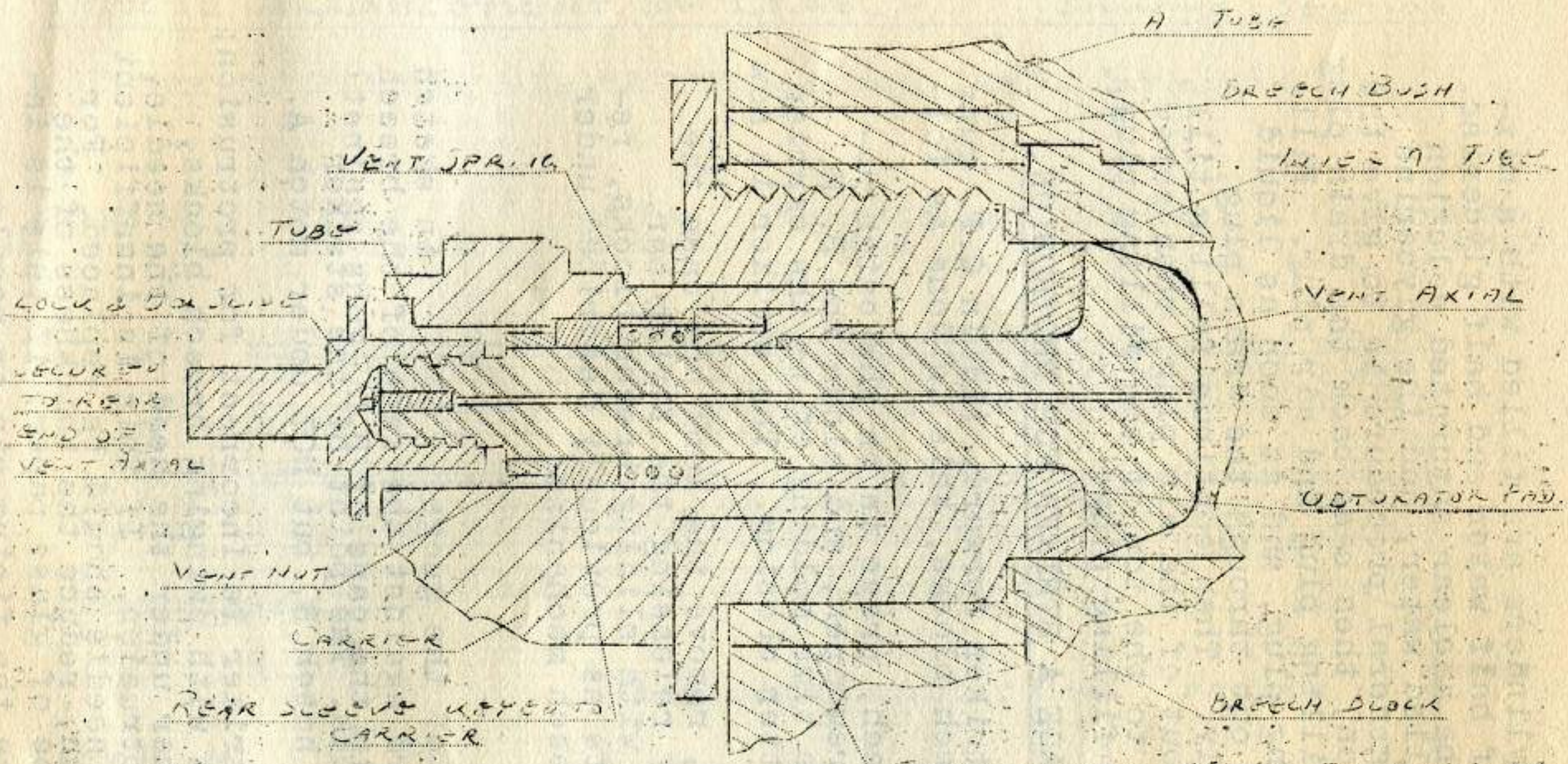
(3) In Q.F. guns with sliding breech-blocks, remove block complete as previously described under examination of breech mechanisms.

The faces CC of the guage in sketch should be kept hard against the face of the breech block itself, or in the case of B.L. guns against the face of the lock. The point of the striker should pass under notch B, but NOT under notch A.

Should the striker be incorrect for protrusion;

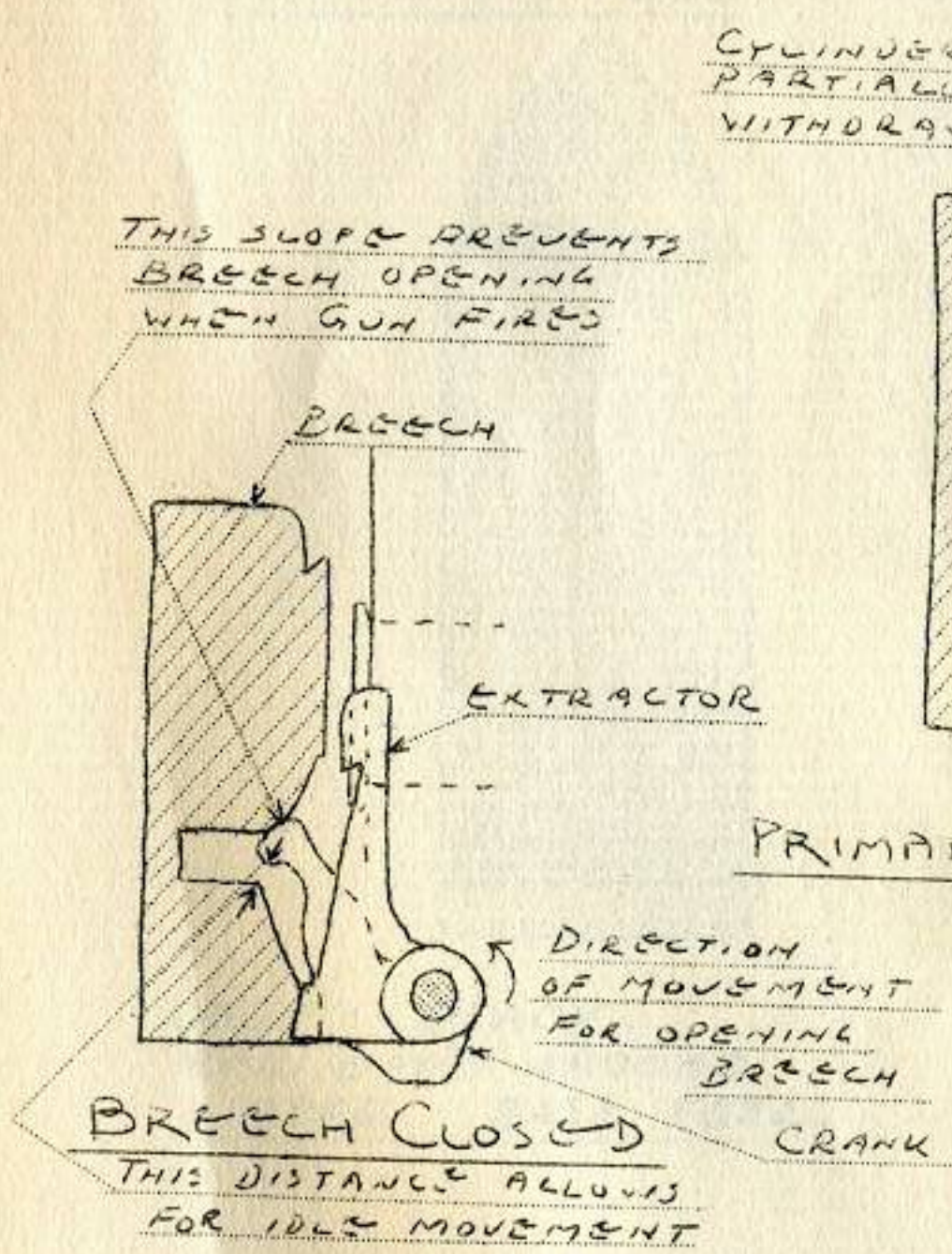
(1) For Q.F. guns with swinging breech blocks, place thicker washer under the head of the needle, for too little protrusion. If this is insufficient the firing pin or needle should be replaced. For too much protrusion, reduce the thickness of the washer with a piece of glass paper; if this is insufficient, replace the firing pin or needle.

TYPICAL ARRANGEMENTS FOR OBTURATION AT B.L. GUNS.

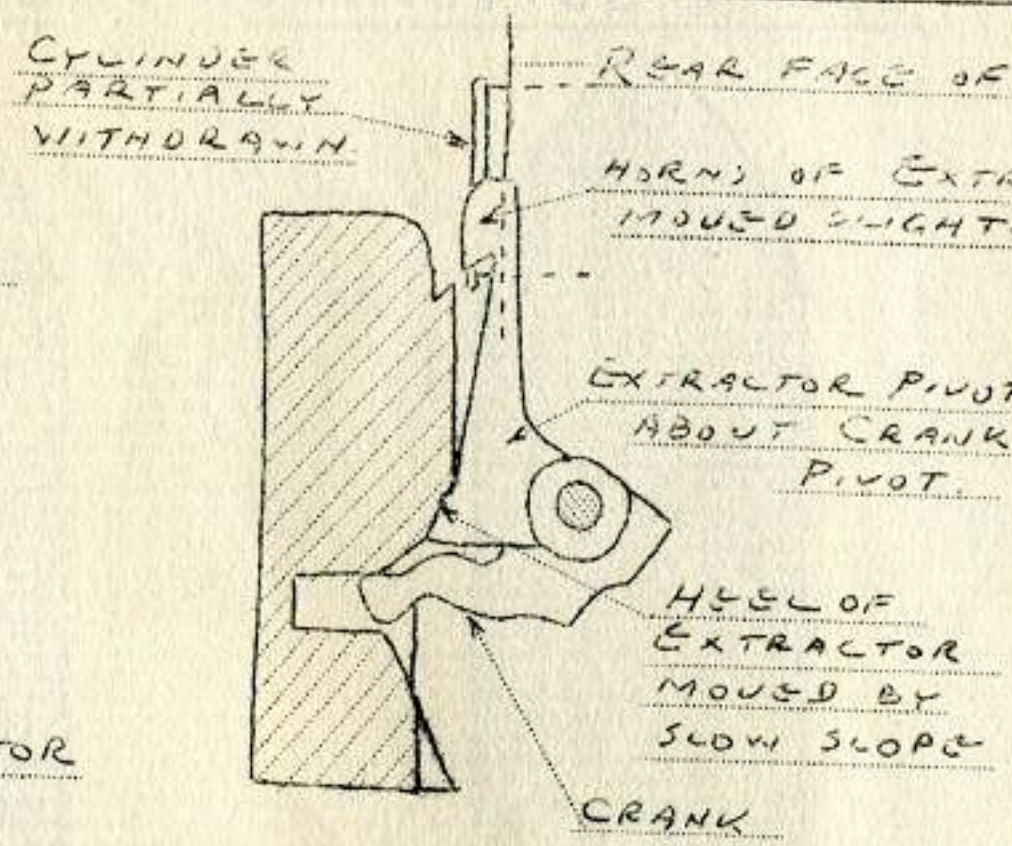


WHEN GUN FIRES PRESSURE IN CHAMBER PUSHES VENT AXIAL TO THE LEFT AND SQUEEZES PAD AGAINST BREECH BLOCK. FRONT SLEEVE REMAINS STILL, REAR SLEEVE AND VENT NUT MOVE TO LEFT WITH VENT AXIAL AND COMPRESSION IS EASED OFF VENT SPRING.

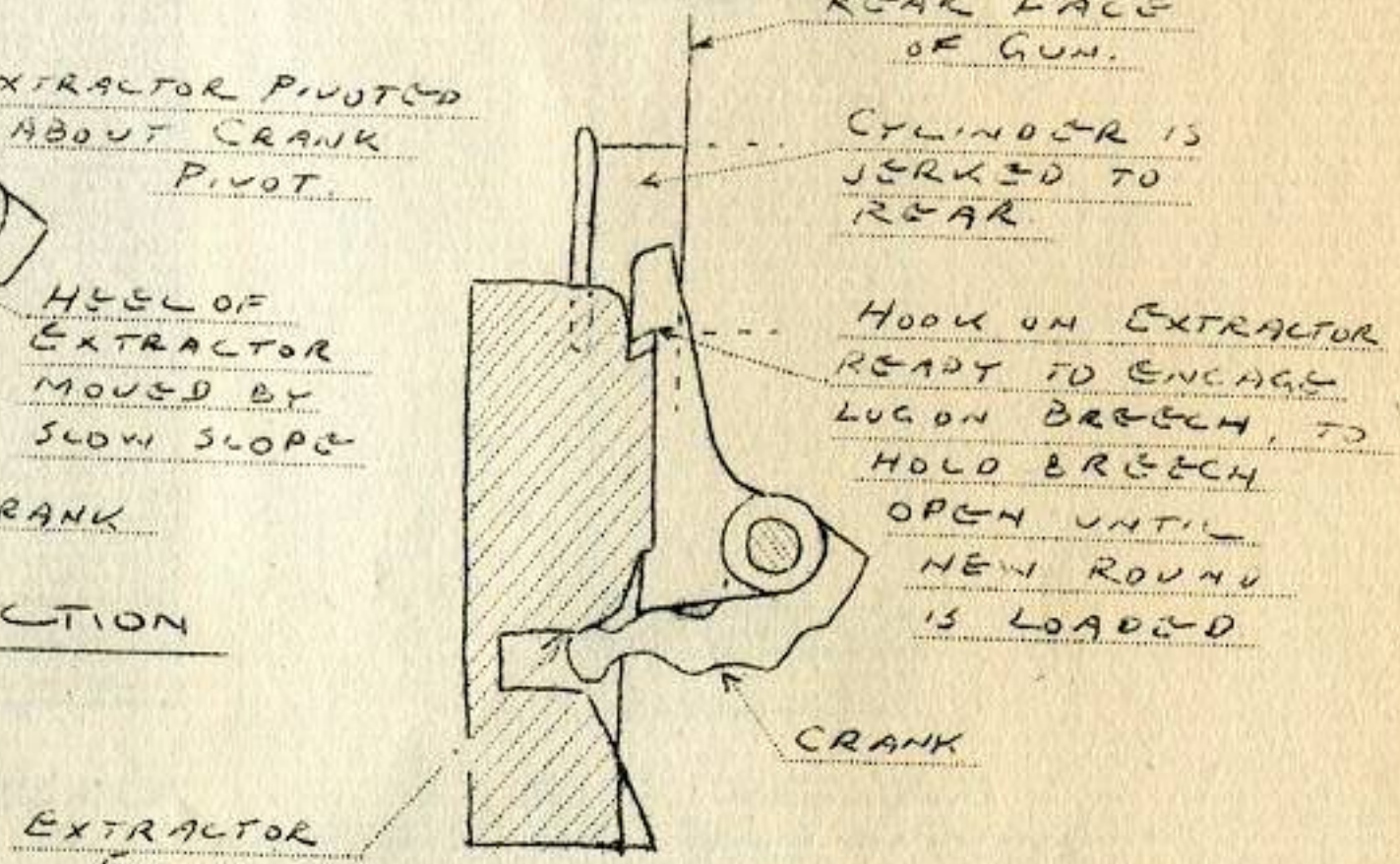
TYPICAL ARRANGEMENT OF EXTRACTION AT A Q.F. GUN.



BREECH CLOSED



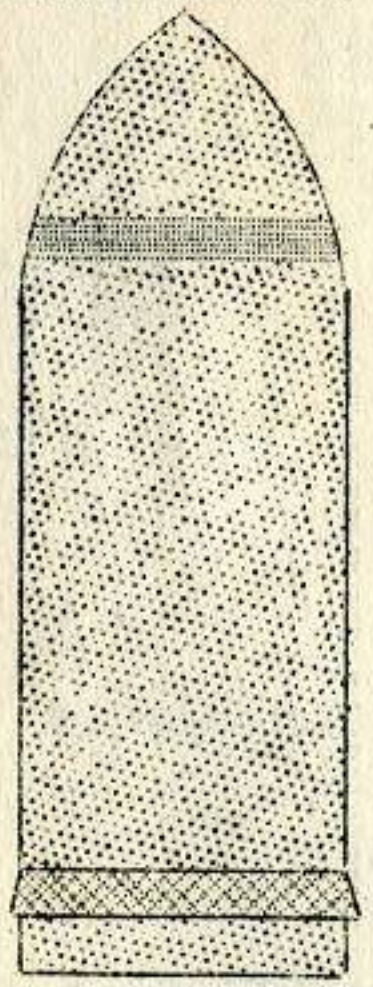
PRIMARY EXTRACTION



FINAL EXTRACTION.

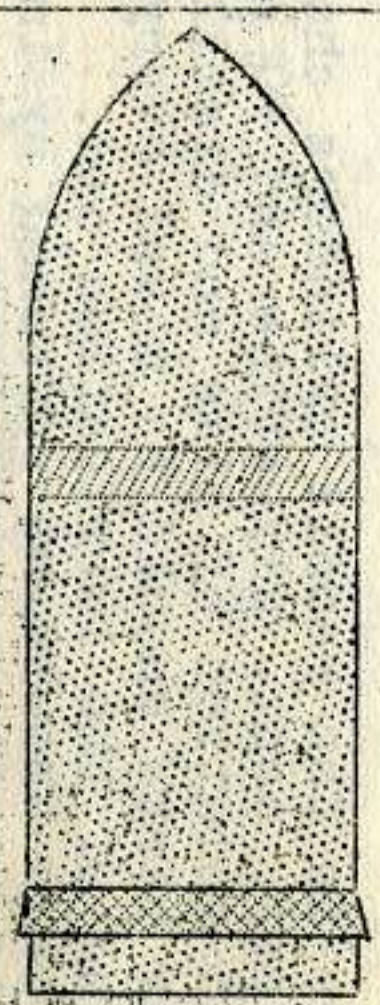
COLOUR MARKINGS OF PROJECTILES

COMMON SHELL



BODY - BLACK.
RED BAND AROUND
HEAD. BASE FUZE.

PRACTICE SHELL



BODY - BLACK
YELLOW BAND AROUND
HEAD. NOSE FUZE.

H.E. SHELL

BODY YELLOW.
RED BAND AROUND
HEAD. NOSE FUZE.

(2) For B.L. locks and Q.F. guns with sliding breech blocks, fit new firing pin.

AMMUNITION. -- The projectiles are to be lightly oiled. If tubes and cartridges are not kept dry there is considerable danger of hanging fire, i.e., of the charge smouldering instead of going off at once, and then perhaps going off some appreciable time after the trigger is pressed. If the cartridges are suspected of being wet they should be laid aside ontill returned to hardor, whem the local officer should be informed at once.

AFTER FIRING,-- The bore must be thoroughly cleaned after firing.

COLD WEATHER.-- In exceptionally cold weather the following points will require attention:-

(1) Driving snow or sleat may form ice in the bore of the gun. This be prevented by keeping the gun at depression and fitting a loos canvas cover over the muzzle.

(2) The mixture in the recoil cylinders should be changed to 60 per. cent. glycerine and 40 per. cent. clear saturated solution of lime and distilled water.

(3) All working parts should be moved every hour, to prevent freezing of the lubrication oil.

(4) Obturator pads should be softened by immersion in hot water, if circumstances permit.

Gunnery School
R.C.N. Barracks
Halifax N.S.
20th February, 1940.