BROWNING MACHINE GUN
.303 in. Mark II

The Browning Gun has been adopted into the Service because of its high rate of fire (1150 rounds per minute), its comparative freedom from stoppages, its adaptability to either right or left hand feed, and as it is belt fed and may be fired by remote control it is used in all fixed gun installations, both wing and turret.

The gun depends on its action on the recoil of the internal moving parts assisted, as the bullet leaves the barrel, by gas pressure on the muzzle. Cooling of the gun is entirely by air flow over the barrel, muzzle attachment and flash eliminator. To prevent freezing at higher altitudes heaters are provided for the working parts.

For purposes of description the working parts are divided into two parts; 44½" Length
1. The recoiling portions, - barrel, barrel extension and breech block.
2. All other parts, or non-recoiling portions.

MECHANISM OR ACTION OF THE GUN

There are two distinct movements which must be considered;-

1. BACKWARD MOVEMENT - This consists of the following operations

(a) ACTION OF RECOIL - When a round has just been fired, recoil action takes place and gas is momentarily trapped in the muzzle attachment. These combined forces drive the ~~barrel~~ BREECHBLOCK to the rear. The ~~barrel~~ BARREL carries with it the barrel extension and the breech block, the ~~latter~~ FORMER being locked to the ~~barrel~~ B.B ~~extension~~ due to the fact that the locking piece is held up, in engagement with the ~~breech block~~ LOCKING RECESS, by the locking piece cam. The boss on the barrel extension forces the barrel return spring plunger backward and compresses the barrel return spring.

(b) UNLOCKING OF THE BREECH BLOCK - As the barrel moves backward, the locking piece pin strikes the slanting surfaces of the lock frame projections, and forces the locking piece down the slope of the locking piece cam. The locking piece is thus withdrawn from the locking recess in the breech block and the breech block is unlocked from the barrel extension.

(c) BACKWARD ACTION OF ACCELERATOR - During the recoil action, the barrel extension bears against the front of the accelerator, and rotates the accelerator backward as far as the accelerator stop. During this movement the shoulders of the accelerator engage in front of the boss on the barrel extension tang, holding the barrel extension and barrel to the rear.

(d) BACKWARD MOVEMENT OF THE BREECH BLOCK - As the accelerator rotates backward, its claws bear against the accelerator face of the breech block and drive the breech block to the rear. During the backward travel of the breech block the return spring is fully compressed.

(e) BACKWARD ACTION OF THE TRANSPORTER - When the gun is in the fired position, the claw on the transporter is engaged in front of the rim of the cartridge held against the cartridge and bullet stops. As the breech block and transporter travel backward this round is withdrawn from the belt, and carried to the rear, being supported by the ejector. On reaching the chamfered face of the transporter guide, the plunger is depressed. The ramp on the cover then forces the transporter down, carrying the live round on to the cartridge face of the breech block.

(f) EXTRACTION AND EJECTION - The empty case in the chamber is held on the FACE OF breech block face in the cartridge RIM guides, and as the breech block moves backward the case is withdrawn from the chamber. Being unsupported it is free to fall off the breech block face when sufficiently clear of the barrel. If the empty case has not already fallen off, positive ejection will take placeduring the downward movement of the transporter, the rim of the live round bearing against the rim of the empty case, forcing it off the face. In the case of the last round in the gun, the ejector bears against the empty case, ensuring complete ejection.

(g) COCKING ACTION - The tail of the cocking lever lies in the cocking lever bracket. When the breech block moves backward the cocking lever is rotated on its axis, and its nose, being engaged in the cocking lever slot in the firing pin, draws the firing pin to the rear, compressing the firing pin spring. The bent of the firing pin bears against the sear, compresses the sear spring, and when the firing pin bent has cleared the sear, the sear is acted upon by its spring and returns to the normal position, ready to engage the firing pin bent when the cocking lever is rotated ~~forward~~ during the forward movement.

(h) FIRST ACTION OF FEED BELT - The stud on the feed lever is engaged in a cam groove on the top of the breech block. As the breech block moves backward the feed lever is rotated, and the nose of the feed lever being engaged in a recess of the feed slide, the feed slide is moved outward acrossthe belt. The feed pawl, being spring loaded, rides over the round held by the retaining pawl, and engages behind that round, ready for feeding. During this whole action the belt is prevented from leaving the gun by the retaining pawl and spring.

FORWARD

2. ~~RECOIL~~ MOVEMENT - This consists of the following operations;-

(a) ACTION OF RETURN SPRING AND BUFFER - On completion of the backward movement the return spring is fully compressed and any surplus energy from the recoil is absorbed by the buffer discs. Thus the force of recoil is expended and the return spring is able to drive the breech block forward.

(b) SECOND ACTION OF FEED BELT - As the breech block moves forward, the stud on the feed lever runs in its cam groove, and rotates the feed lever. This causes the feed slide to move inward, feeding the belt in, until the next round is against the cartridge and bullet stops. During this movement the retaining pawl and spring are depressed by the second round in the belt and engage behind that round, holding the belt during the next backward movement. This ensures continual ammunition supply.

(c) RETURN OF THE COCKING LEVER - During the forward travel of the breech block the tail of the cocking lever engages in the cocking lever bracket, causing rotation of the cocking lever. This action resets the cocking lever, permits engagement of the sear and bent, and at the same time permits clearance for the firing pin to travel forward when released.

(d) FORWARD ACTION OF THE TRANSPORTER - As the breech block travels forward the transporter plunger rides down the sloping face of the transporter CAM ~~guide~~, until the transporter arm reaches the transporter stop. During the downward movement the live round is brought into line with the chamber and the firing pin hole. The round is still supported by the ejector. The continued forward movement of the breech block feeds the round into the chamber. When the ejector is brought abreast of the ejector side clearances in the barrel extension, the transporter plunger rides up the transporter cam. This causes the transporter to rise, lifting the ejector clear of the round. The ejector, being spring loaded, rides over the round, and when clear of the round returns to its normal position. As the transporter reaches its fully forward position, its claw rides over the rim of the live round in the belt, and under pressure from the cover transporter guide spring, engages in front of it. At the same time the ejector is forced down over the side of this round, and embraces it, ready to support it when the next backward action commences.

(e) FORWARD ROTATION OF THE ACCELERATOR - When the accelerator face of the breech block strikes the claws of the accelerator, the latter is rotated forward. The shoulders of the accelerator become disengaged from the boss on the barrel extension, and the barrel& barrel extension are driven forward by the barrel return spring.

(f) LOCKING OF THE BREECH BLOCK- As the barrel moves forward under the influence of the barrel return spring the locking piece pin is carried away from the lock frame projections. When the breech block is home, and the breech closed, the locking piece is forced up by the slope of the locking piece cam, enters the locking recess on the under side of the breech block and thereby locks the breech block to the barrel extension. This action takes place while the recoiling portions are moving forward, and assures absolute locking of the breech bloch before the round can be fired.

(g) FIRING OF THE CARTRIDGE - When the breech block is right forward, i.e. closed and locked, the lower lug of the sear is brought into line with FIRING SAFE M/C the read end of the ~~Trigger~~ Motor push rod slot. The push rod is thus able to strike the sear and drive it inwards. The sear disengages from the bent in the firing pin, and the firing pin is carried forward by its spring, the striker point protrudes through the firing pin hole in the face of the breech block and fires the cartridge.

(h) OPERATION OF THE SEAR - On ceasing to operate the controls the rear sear is free to rise under impulse from its spring. During the backward movement of the breech block, as a result of the firing of the cartridge, the lower rear surface of the breech block depresses the sear, and when cleared the sear rises. As the breech block starts forward under pressure by the return spring, the movement is arrested by the sear coming in contact with the accelerator face of the breech block. The shock of this impact is taken up by the buffer spring, against which the cradle rests. An inclined ramp on the sear ensures complete engagement of the sear, should only partial engagement result in the first instance.

SAFETY ARRANGEMENTS

The upper surface of the locking piece cam, ensuring a forward movement of approximately 5/16 of an inch after the breech block is locked and before the cartridge is fired, assures positive safety for firing.

Similarly, the 5/16 of an inch that the recoiling portions must move before the unlocking of the breech block, ensures complete dissipation of the gases in the barrel, thereby eliminating any chance of 'blow-backs' or premature unlocking of the breech block with resultant damage to gun or danger to firer.

SEQUENCE OF STRIPPING

1/ Ensure Gun is unloaded.

a. Remove the Flash Eliminator
b. Remove the Back Plate
c. Remove the Return Spring
d. Raise Breech Cover
e. Remove Cocking Stud
f. Remove Breech Block
g. Remove Lock Frame and Barrel Assembly
h. Separate Lock Frame from Barrel Extension
i. ~~Separate Barrel Extension from Barrel~~
j. ~~Remove Barrel Locking Spring~~
k. ~~Remove Locking Piece from Extension~~

TO REASSEMBLE - Reverse above procedure taking care to assemble Locking Piece to Extension with chamfered edge uppermost and to the front. When inserting Barrel Assembly into body care must be taken to depress sear.

BREECHING UP THE BARREL

'Breeching Up' is the correct positioning of the breech and of the barrel against the front end of the breech block, and must be done in such a manner that the locking piece is in complete engagement with the locking recess in the breech block. The following is the procedure;- Assuming that the barrel is screwed home in the barrel extension

1. Remove recoiling portions from gun casing.
2. Remove the transporter, switch-plate and switch-plate plunger and spring from breech block.
3. Unlock barrel from barrel extension, placing barrel locking spring on side of extension.
4. Unscrew barrel about 1/4 of a turn.
5. Assemble stripped breech block to barrel extension.
6. Rotate assembly 180 degrees, and make sure that locking piece is engaged.
7. Tighten up the barrel until it is felt to bear on the face of the breech block.
8. Engage the barrel locking spring in appropriate notch. If spring will not engage unscrew barrel until a notch is under spring. NEVER TIGHTEN BARREL to obtain this locking.
9. Turn assembly right side up, and holding the locking piece up, test breech block to ascertain amount of play between the block and extension. There should be very little, and it should not be absolutely tight, otherwise the barrel is 'OVER-BREECHED'.

CHANGING DIRECTION OF FEED

It is possible by the positioning of certain portions of the gun to adapt the gun to either right or left feed. The positions shown hereunder are for right-hand feed. For left-hand feed the positions are reversed.

EJECTOR ;- With its nose and spring on left side of transporter.
SWITCH PLATE;- Fitted so that the cam groove co-incides with the appropriate cam groove on the block, i.e. to R for right-hand feed, and to L for left-hand feed.
RETAINING PAWL and SPRING;- On right side of feed opening.
FILLING PIECE;- On left side of feed opening opposite Retaining Pawl.
BULLET STOP;- In front slot on left side of feed opening.
CARTRIDGE STOP;- In rear slot on left side of feed opening.
FEED PAWL EXTENSION;- Positioned to Feed Pawl so that it is on side of pawl nearest rear of gun when pawl in slide is in gun.
FEED SLIDE;- Placed in gun so that pawl is on right side.
FEED LEVER PLUNGER and SPRING;- Placed so that the spring forces the slide to the innermost position, i.e. in the lower hole on the side of the lever.

TO LOAD THE GUN:- Raise the breech cover, place first cartridge in belt against the bullet and cartridge stops, with the smooth side of belt uppermost. Engage the transporter claw. Close the cover. Cock the gun by pulling back on cocking stud. THE GUN IS THEN FULLY LOADED, the breech block being held to the rear and the live round ready for feeding into chamber.

TO UNLOAD THE GUN:- Raise cover, pull breech block to rear, raise transporter, knock off round on face of breech block. Remove belt from feed opening. Allow breech block to go forward. Close cover.

A R M A M E N T

ADJUSTING THE CARTRIDGE HEAD SPACE WHEN ASSEMBLING AFTER CLEANING OR EXAMINATION

1. Raise the locking spring and support it on the side of the barrel extension to prevent it engaging with the notches when screwing up the barrel.

2. Start the barrel threads into the barrel extension and stop before the barrel is right home.

3. Place the breech block, with the transporter, switch plate complete with its plunger and spring and cocking lever removed, into its guides in the barrel extension and push it right home.

4. Raise the locking-piece , and hold it firmly in its recess in the breech block, rotating the assembly to ensure that the locking-piece is fully engaged.

5. Screw up the barrel until it comes in contact with the face of the breech block and then engage the barrel locking spring. Should a notch not register, unscrew the barrel the requisite amount to allow it to engage with the next notch.

6. Assemble the barrel, barrel extension and breech block (with the parts removed as above) into the gun and ensure that they are in the forward position and the barrel right home.

7. Hold the barrel extension steady and test the breech block for movement in a fore-and-aft direction; if any movement takes place, remove the components and screw up one more notch.

8. Repeat the operations described in Para. 6 and 7 until end play has been eliminated.

9. If the position of the barrel extension, relative to the face of the trunnion block, indicates that the recoiling parts have not gone fully forward, the gun is overbreeched and the components must be removed and the barrel unscrewed one notch and tested for closing and end play as before.

ADJUSTING THE CARTRIDGE HEAD SPACE WHEN THE GUN IS COMPLETELY ASSEMBLED.

1. It may be necessary to adjust the cartridge head space after the gun has been assembled , for example at inspection between flights if a stoppage due to a separated case has been reported.

2. Remove the gun from the aeroplane. (With some installations it may be possible to adjust the gun "in situ").

3. Raise the breech cover and remove the back plate and return spring.

4. Remove the breech block and withdraw the lock frame barrel extension and barrel , until the breech end of the barrel is clear of the rear of the breech casing. Remove the lock frame from the barrel extension.

5. Disengage the barrel locking spring and support it on the side of the barrel extension to prevent it from engaging with the notches when adjusting the barrel.

6. Unscrew the barrel about $\frac{1}{2}$-turn.

7. Proceed as described in Para. 3 to 9 above.

BROWNING GUN - NAMES OF PARTS

RECOILING PORTIONS

BARREL GROUP - Barrel
Locking Notches
Ejector Top Clearances
Ejector Side Clearances
Tang
Boss
Barrel Extension Stud
Barrel Locking Spring
Locking Piece
Locking Piece Pin
Locking Piece Cam Grooves
Clearances for T.M. Push Rod
" " F. & S. Mech.
Breech Block Guide Grooves

BREECH BLOCK - Breech Block
Cartridge Face
Cartridge Guides
Accelerator Face
Transporter Stop
Cam Grooves
Locking Recess
Return Spring Housing
Cocking Stud Housing
Guide Ribs
Sear Housing
Sear Retainer Housing
Switch Plate Housing
Transporter Housing
Firing Pin Housing
Sear Spring Retainer
Keeper Housing
Cocking Stud Pin

FIRING PIN - - Firing Pin Spring Pin
Bents (2)
Firing Pin Spring
Firing Pin Spring Housing
Cocking Lever Slot
Striker

SWITCH PLATE - Plunger
Spring

COCKING LEVER - Nose - Tail

SEAR - - - - Bent
Spring
Sear Retainer
Sear Spring Retainer
Spring Housing
Sear Spring Retainer
Keeper and Pin
Stud
Sear Retainer Stops

TRANSPORTER - - Arm
Horn
Claw
Plunger and Spring
Ejector and Spring
Ejector Pin

COCKING STUD - -

NON-RECOILING PORTIONS

BARREL CASING - Muzzle Attachment
Front Barrel Bearing
Muzzle Attach. Chamber
Flash Eliminator

LEFT SIDE PLATE - Transporter Cam
Transporter Guide
Retainer Hole

RIGHT SIDE PLATE - Return Spring Rod
Recess

BREECH CASING - Trunnion Block
Rear Barrel Bearing
Lock Frame Grooves
Cocking Stud Slots
T.M. Slots
Plunger Clearances
Detent Pawl
Detent Pawl Housing
Breech Block Guide Ribs
Blast Tube Adapter

BOTTOM PLATE - Locking Piece Cam
Rear Sear Release Unit
Flanges
Operating Slots

TOP PLATE - - - Cocking Lever Bracket

BACK PLATE - - - Catch and Plunger
Buffer Plate
Buffer Tube and Screw
Screw Plunger and Spring
Buffer Discs (22 fibre)

FEED OPENING - Retaining Pawl and Spring
Bullet Stop
Cartridge Stop
Filling Piece
Chute Lugs
Retaining Pins (2)

BREECH COVER - Pin
Ratchet Teeth
Slide Recess
Slide Grooves
Cover Catch and Pin
Catch Spring and Stud
Catch Lever and Pin
Feed Lever
Feed Lever Stud and Bush
Feed Lever Plunger
S
Transporter Guide Spring
Transporter Ramp

FEED SLIDE - - Feed Pawl
Feed Pawl Extension
Guide Ribs
Feed Pawl Pin & Spring

LOCK FRAME - - Projections
Accelerator Stop
Accelerator and Pin
Accelerator Claws
Accelerator Shoulders
Frame Guide Ribs
Barrel Return Spring
Bar. Ret. Spring & Plunger
Rear Sear with
Plunger and Spring
Rear Sear Axis Pin
Rear Sear Cradle
Rear Sear Lever & Pin
Rear Sear Buffer Spring
Barrel Return Spring
Socket
Lock Frame Retainer
Retainer Tube, Spring &
Stud

RETURN SPRING - Rod - Stop Pin
Collar and Head

Sequence of stripping the Breech Block.

Tools Required.

1/ Drill Cartridge
2/ No 6 Drift or a nail (2")

a/ Cock & fire the breech block.
b/ Raise transporter & remove.
c/ Remove switch plate & plunder.
d/ Remove cocking lever stud & cocking lever.
e/ Centralise the sear spring retainer keeper.
f/ Sear spring retainer.
g/ Sear spring.
h/ Sear retainer.
i/ Sear.
d/ Firing pin.

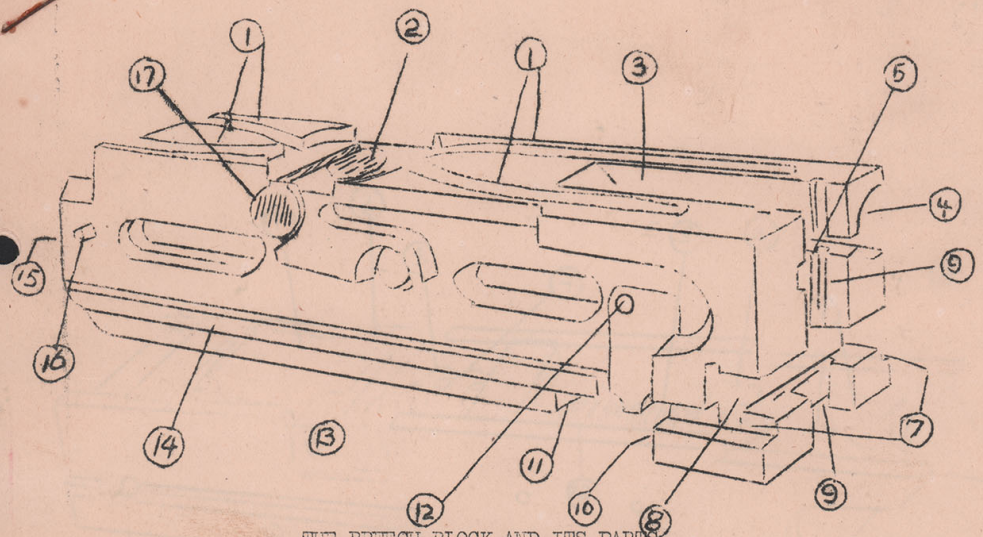
Assembly:

a/ Place firing pin in with striker uppermost
b/ Position sear.
c/ Sear retainer; place 2/3 way up slot.
d/ Place spring in
e/ Place retainer sear spring (us SBRK to compress spring)
d/ Place in Sear spring retainer keeper

Feed Paul feed to slide & spring
Slide complete

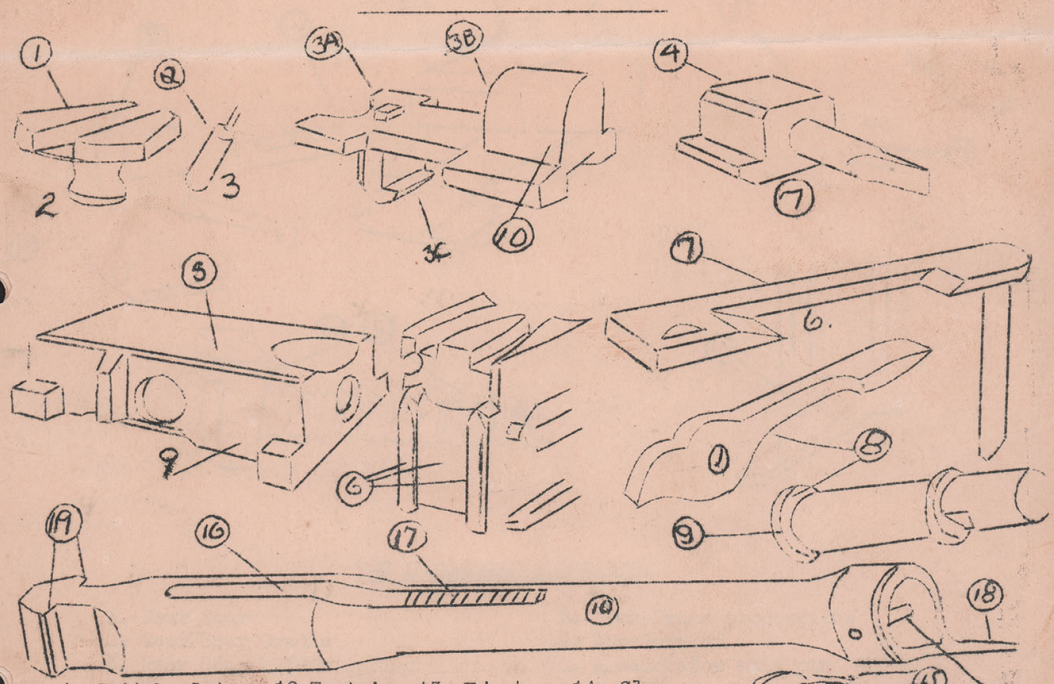
STOPPAGES AND IMMEDIATE ACTION

POSITION OF COCKING STUD	IMMEDIATE ACTION	RESULT	CAUSE	REMEDY
FIRST	COCK AND FIRE GUN, WATCH THE FEED.	(1) GUN FIRES	MISFIRE DUE TO DEFECTIVE AMMO:	NIL
		(2) GUN REPEATS STOPPAGE	(1) BROKEN FIRING PIN SPRING OR BROKEN STRIKER	CHANGE BREECH BLOCK
			(2) DIRT, CONGEALED OIL OR BRASS CHIPS IN F.P. HOUSING OF BREECH BLOCK	CLEAN OR CHANGE BREECH BLOCK
			(3) DEFECTIVE FIRING SYSTEM OR INSUFFICIENT PRESSURE IN SYSTEM	INSPECT SYSTEM
		(3) GUN DOES NOT FIRE , FEED DOES NOT TAKE PLACE	(1) DEFECTIVE TRANSPORTER	CHANGE DEFECTIVE PART
			(2) BROKEN FEED-PAWL-SPRING	CHANGE DEFECTIVE PART
			(3) BROKEN RETAINING-PAWL-SPRING	CHANGE DEFECTIVE PART
SECOND	COCK GUN	GUN DOES NOT FIRE	(1) LOOSE LINK IN FEED OPENING	UNLOAD, CLEAR GUN, RELOAD AND FIRE
			(2) CROSS FEED DUE TO BELT JAMMING IN FEED OPENING.	UNLOAD, CLEAR GUN, RELOAD AND FIRE
			(3) BROKEN TRANSPORTER PLUNGER OR SPRING	CHANGE BROKEN PART
			(4) SEPARATED CASE	CLEAR GUN AND FIRE
THIRD	COCK GUN RAISE BREECH COVER, CLEAR GUN AND FIRE	(1) GUN FIRES	DEFECTIVE AMMUNITION	NIL
		(2) GUN DOES NOT FIRE	(1) DEFECTIVE BREECH BLOCK	CHANGE BREECH BLOCK
			(2) DEFECTIVE EJECTOR	CHANGE BREECH BLOCK

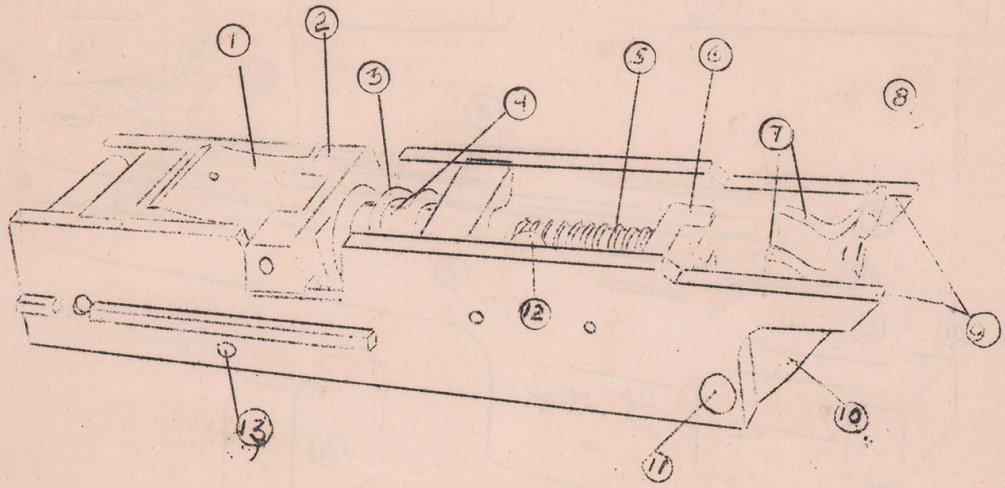


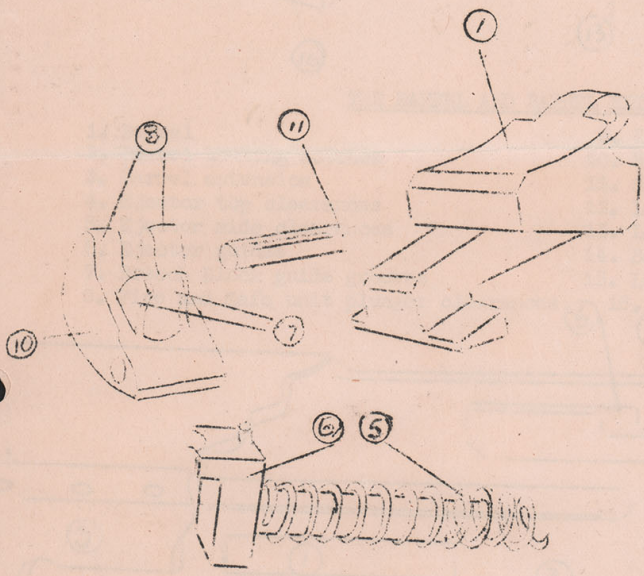
THE BREECH BLOCK AND ITS PARTS.

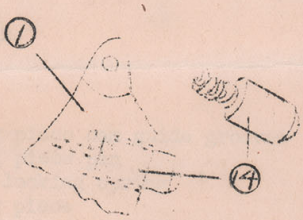
1. Cam grooves
2. Switch plate housing
3. Cocking lever housing
4. Return spring housing
5. Sear spring retainer housing
7. Fire & safe unit plunger clearances
8. Scar housing
9. Scar retainer housing
10. Accelerator face
11. Locking recess
12. Cocking lever axis pin housing
13. Cocking stud housing
14. Breech block guide rib
15. Cartridge face
16. Transporter stop
17. Transporter axis housing.

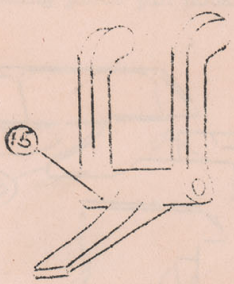


1. Switch plate
2. Switch P. plunger
3. (a)Sear(b)Spring housing (c)Bent
4. Sear spring retainer
5. Sear retainer
6. Cartridge face & guides
7. Sear spring retainer keeper & pin
8. Cocking lever
9. Cocking stud
10. Firing pin
11. Transporter
12. T. Axis.
13. Ejector
14. Claw
15. Horn
16. Cocking lever slot.
17. Spring
18. Striker
19. Bents
20. Firing pin spring pin.



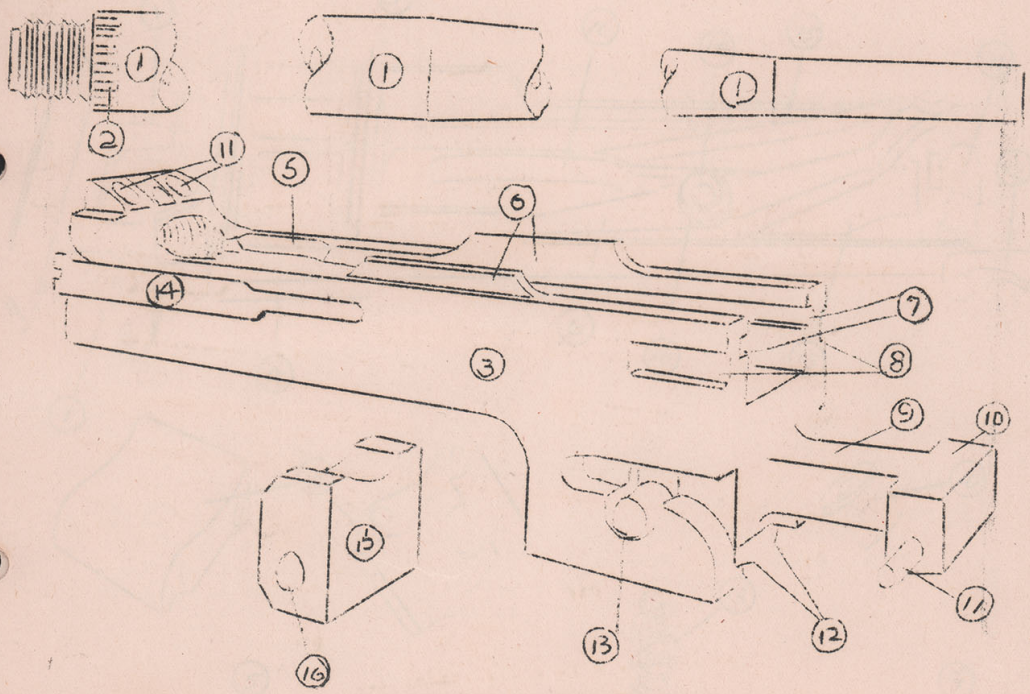






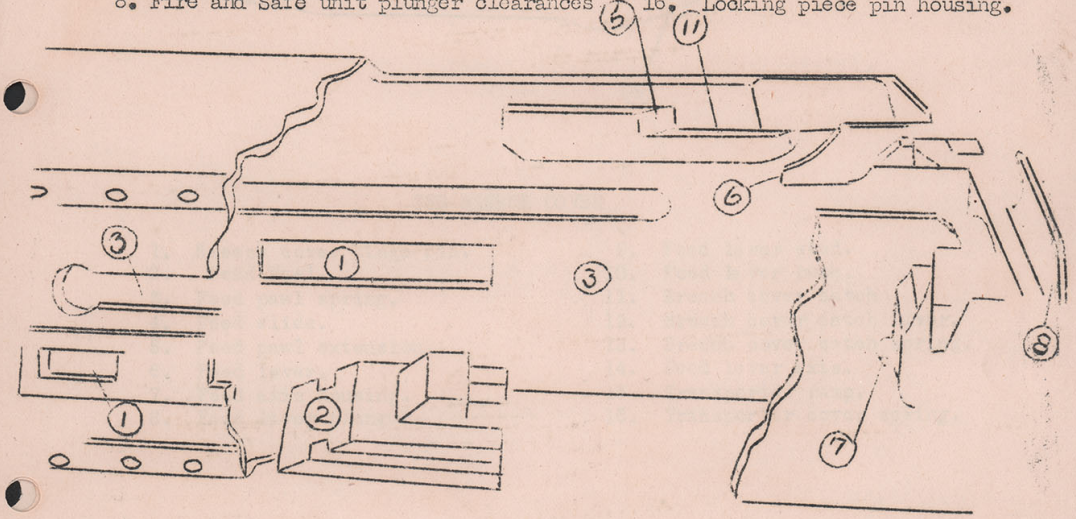
THE LOCK-FRAME AND PARTS.

1. Rear Sear
2. Rear Sear Cradle
3. Rear Sear buffer spring
4. Barrel return spring housing
5. Barrel return spring
6. Barrel return spring plunger
7. Accelerator shoulders
8. Accelerator claws
9. Lock-Frame projections
10. Accelerator
11. Accelerator axis pin
12. Accelerator stop
13. Rear Sear lever axis pin
14. Rear Sear plunger and spring.
15. Rear Sear lever.



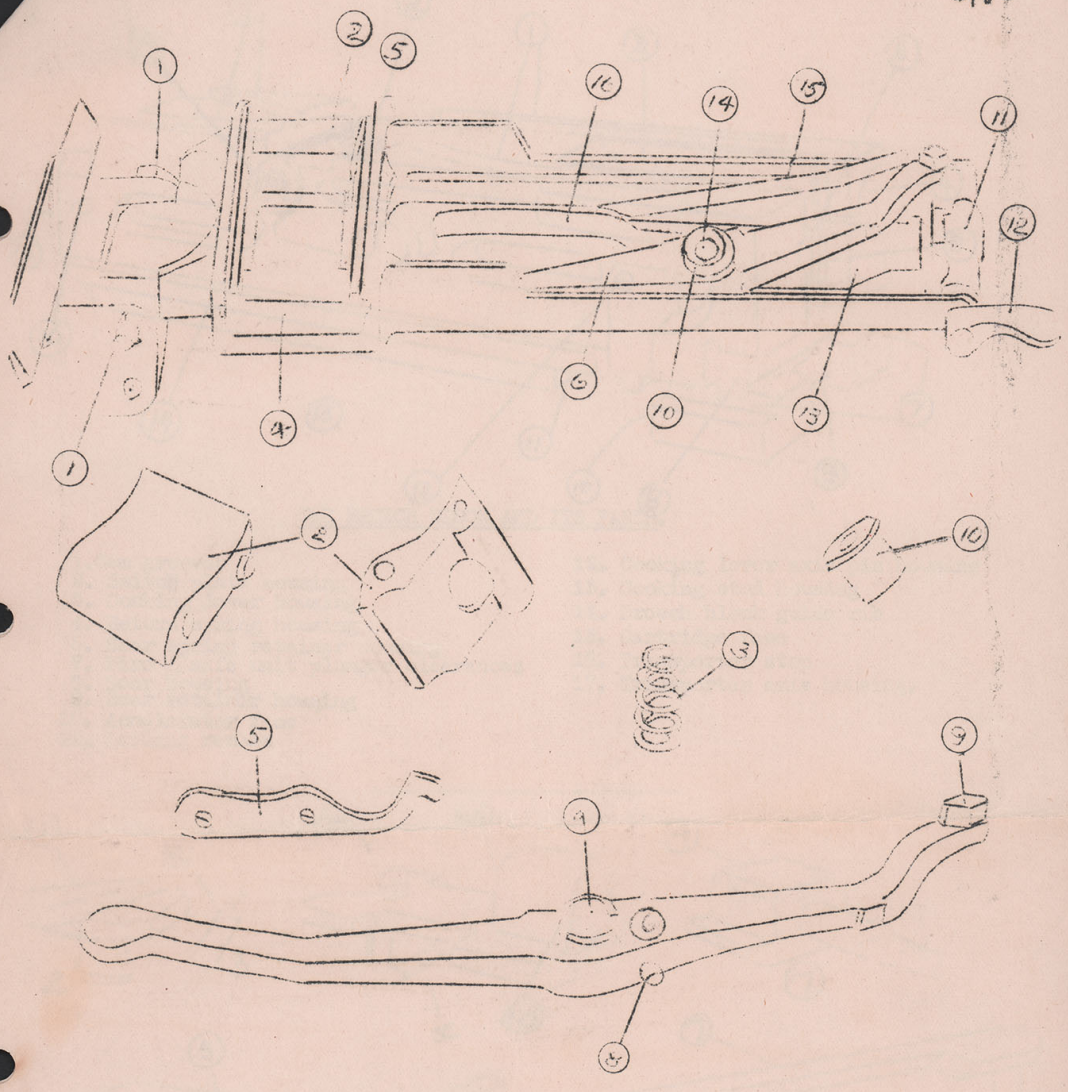
THE BARREL AND BARREL EXTENSION.

1. Barrel
2. Barrel locking notches
3. Barrel extension
4. Ejector top clearances
5. Ejector side clearances
6. Ejector guides
7. Breech Block guide grooves
8. Fire and Safe unit plunger clearances
9. Tang
10. Boss
11. Stud
12. Locking piece cam guide grooves
13. Locking piece pin
14. Barrel locking spring
15. Locking piece
16. Locking piece pin housing.



THE BREECH CASING.

1. Clearances for fire & safe unit
2. Locking piece cam
3. Locking stud slot
4. Transporter guide
5. Champhered face
6. Transporter cam
7. Retaining pin for chute lugs etc.
8. Cartridge stop.



THE BREECH COVER

1. Breech cover hinge pin.
2. Feed Pawl.
3. Feed pawl spring.
4. Feed slide.
5. Feed pawl extension.
6. Feed lever.
7. Feed axis housing.
8. Feed lever plunger.
9. Feed lever stud.
10. Feed lever bush.
11. Breech cover catch
12. Breech cover catch lever.
13. Breech cover catch spring.
14. Feed lever axis.
15. Transporter ramp.
16. Transporter cover spring.

Since the deflection has changed from one side to the other, there must be a position in between these two, requiring no deflection. This position is given when the attacking aircraft is changing from parallel course to curve of pursuit. Thus an opportunity for a no-deflection shot arises when the attacking aircraft is turning. This shot should be taken immediately the gunner sees the fighter banking over in his initial turn to get his guns on and should be continued until he has banked in the opposite direction to begin his curve of pursuit. All gunners should be ready to seize this opportunity when it presents itself.

PARALLEL COURSE -- NO-DEFLECTION SHOT.

6. On parallel courses when the target is being overtaken, the allowances for difference in speed and for bullet trail will be in opposite directions. This means that for a certain definite range there will be an overtaking speed which will cancel out the bullet trail effect and so present the gunner with a no-deflection shot. This shot will seldom be met on operations, but will frequently occur when firing at drogue targets, e.g. gunner's aircraft flying at approximately 150 miles per hour and overtaking the drogue at 20 miles per hour at a range of 300 yards, a no-deflection shot will result.

GROUND STRAFING.

7. Ground strafing, to be effective, must be carried out at low altitude. The front gunner should open fire with a deflection of 2 Rads. short of the target and increase this deflection as the target is approached. Since the observed end point of the tracer will always be at the range of the target, correction of aim should be made by bringing this end point on to the target. The rear gunner will see his target moving away from him and should open fire with 3 Rads deflection beyond the target and reduce this deflection as the range increases. Correction of aim to bring the observed end point of the tracer on to the target must be made.

Rules for Aiming.

RULES FOR AIMING -- CURVE OF PURSUIT ATTACK.

1. The rules applicable when the fighter is pressing home his attack must be thoroughly understood and learnt by heart until the actions taken by you at the various stages are automatic. These rules are :-

(i) Recognise the aircraft.

(ii) Estimate the range.

(iii) Make the necessary Zone allowance towards own tail.

(iv) At 600 yards fire a burst and note the end of the trace.

(v) Keep firing with the target at the end of the trace.

(vi) At 400 yards adjust aim to bring the target half way along the existing trace.

(vii) Maintain this aim and keep firing until the range closes to 150 yards. Then fire point-blank until the breakaway.

(viii) On breakaway build up a deflection of 1 Rad in the direction of the breakaway, firing continuously.

RULES FOR AIMING -- TARGET HOLDING OFF.

2. When the aircraft does not press home his attack, the above rules can be used up to and including (iv), but now we must readjust our aim, using the full accuracy possible by the tracer method. That is, the target when holding off must be placed at the correct point on the trace for his exact range and deliberate aim must be taken.

RULES FOR AIMING -- PARALLEL COURSE.

3. Use rules (i) and (ii) of paragraph 1 and allow 2 Rads ahead of the enemy aircraft. Correct aim from trace.

COORDINATION OF RULES DEMONSTRATED BY AN IMAGINARY ATTACK.

4. We will now consider an imaginary attack by a fixed gun fighter in the light of the rules for aiming which we have just summarised. Let us suppose that the fighter is first seen from our mid-upper turret away on the starboard quarter, at about 1,200 yards range and overtaking on a parallel course. The fighter continues overtaking and eventually he is near enough to be identified. Suppose the enemy fighter is in our first group for range estimation. At 600 yards, aircraft of this group will fill one half of the radius of our sight. Place the aircraft between the ring and the centre spot, with the rear edge of the silhouette on the ring. When the silhouette has grown to fill half of the ring radius, make an allowance of 2 Rads ahead of the enemy aircraft and open fire keeping the target steady at this deflection. Watch carefully the position of the point of the trace. If this is on the target continue to fire with this allowance. If the target is not on the end point of the trace, make the necessary small adjustment to bring it there and continue to fire.

5. If, after firing this burst, he continues to make his attack, the next thing you will see will be the target turning towards you. Almost immediately afterwardsthe target banks in the opposite direction to begin his curve of pursuit. During this period fire with no deflection.

6. From now on the fighter is following a curve of pursuit and the opening burst for this part of the attack must be fired with the target correctly positioned for the appropriate zone allowance. The range will probably, at this stage, be in the region of 400 yards. Fire a burst, keeping the target steady in the zone position and observe the point where the trace disappears. Make any adjustment which is necessary to bring the target halfway along the trace.

7. Continue to fire and you should realise that the correct position for the target, although still halfway along the trace, is progressively nearing the centre as the trace length is shortening. During this time the range will be closing and when the aircraft fills 2 Rads (i.e. is at 150 yards) fire continuously point-blank until the breakaway. (Air Diagram 2176). On the breakaway, build up a deflection of 1 Rad in the direction of the target's movement, firing continuously.

CONCLUSION.

8. In conclusion let us recall that the process of learning never ceases. You cannot do too much aircraft recognition, range estimation, turret manipulation, observation of tracer and of the peculiar motions of aircraft when seen from the air. In the classroom we can only give you the framework of the picture; it is up to you to fill in with the colour of achievement. We cannot teach you everything, but by now you should have sufficient knowledge to enable you to begin to think for yourselves. In A.P. 1730B, Volume 1, you will find the theory of sighting dealt with in great detail. Valuable information can also be obtained by conversing with your fellow gunners and by reading tactical papers and combat reports. Even when you are "fully operational" you can still learn.

STANDARD GUNNERY PATTER.

	PILOT	GUNNER.
1. Prior to Take-off	All crew to have parachutes, synchronised watches, discuss exercise, test intercommunication. Gunner to check guns, sight, ammunition, turret.	
2. When ready for Take off	"Ready for Take-off"	Ready for Take-off"
3. As A/C nears Tow-line	"Turret Selected" "Load Gun" "Safety On"	"Turret Operating" "Gun Loaded" "Safety On"
4. When A/C positioned on target and "Carry-on" signal received.	"Safety Off" "Target on.....side (Red or Green)" "Commence Firing"	"Safety Off" "Target on.....side" Commences Firing.
5. At end of Tow-line, or cease fire signal given, or any occasion pilot wishes firing to cease for any reason.	"Cease firing Safety On"	Ceases Fire "Safety On"
6. To recommence firing	"Safety Off" "Commence Firing"	"Safety Off" Commences firing
7. When gunner has completed firing his rounds or time up.	"Safety on, Change positions".	"No.....Gunner completed, Safety On".
8. Next Gunner in position.	carries out appropriate patter as in paras.4, 5,6,& 7.	"No.....Gunner ready".
9. Last Gunner finished or time and drogue over	"Unload and Clear Guns" "Safety On"	"Guns unloaded and cleared". "Safety On".
10. In the event of a Stoppage	"Stoppage" "Carry on firing" (or appropriate patter)	"Stoppage" Clears Stoppage "Stoppage Cleared"
11. If unable to clear Stoppage	Ascertain difficulty and give advice if possible. If gunner still unable to clear. "Unload Gun" "Safety On" "Guns Central" and Elevated"	Unable to clear stoppage". "Gun Unloaded" "Safety On" "Guns Central" and Elevated"

...ING PROG...

Officer i/c Night Flying .....F/... ...aker A.C.P.....Sgt ...shaw.
Officer i/c Flight.....F/O M... ...eanor Duty Signaller.....LAC Sweet (772)
Duty W.Op. in Ground Station....Cpl Patterson. Flare Path Party....LAC Stickley (624)
Duty W.Op. in Flights.....AC Stokes. LAC Thom (915) & LAC Turner (373)
Duty Electrician.....AC Smuggs. Plotting Office..... F/O Howard, Sgt Brown
Duty Meteorologist.....Cpl Graham. AC Pawson.

No: 5 Target - "D" Flight

Heights :	Even	Details:	L.- 6000'. F.-5750'.	Odd details:	L.-6500'.	F.- 6250'
1	K	F/S Wilson	Bywater & Holbrook		18.50	19.10
	L	F/O Dryden	Kell & Hilson			20.00
2	M	F/S Lane	Kedd & Valler		19.40	20.00
	N	P/O Radley	Walford & Wallen			20.50
3	K	F/O McCreanor	Wilkinson & Pitcairn		20.30	20.50
	L	Sgt Compton	Pierssene & Leeming			21.40
4	M	F/S Imeson	Bywater & Holbrook		21.20	21.40
	N	Sgt Robinson	Kell & Longworth			22.30
5	K	F/O McCreanor	Luff & Greasley		22.10	22.30
	L	Sgt Compton	Jones (039) & Lyon			23.20
6	M	F/S Imeson	Pierssene & Rooney		23.00	23.20
	N	Sgt Robinson	Leeming & Kesler			00.10
7	K	F/O McCreanor	Goodbody & Brazil		23.50	00.10
	L	Sgt Compton	Brimble & Campbell			01.00
8	M	F/S Imeson	Crawshaw & Day		00.40	01.00
	N	Sgt Robinson	Douglas & Judge			01.50
9	K	F/S Clarke	Kenny & Lawson		01.30	01.50
	L	F/S Harrison	Leadbetter & Gilkes			02.40
10	M	Sgt Misbet	Wallace & Mason		02.20	02.40
	N	Sgt Temple	Brazil & Goodbody			03.30
11	K	F/S Clarke	Brimble & Campbell		03.10	03.30
	L	F/S Harrison	Crawshaw & Day.			04.20
12	M	SgtMisbet	Douglas & Judge		04.00	04.20
	N	Sgt Temple	Kenny & Lawson			05.10
13	K	F/S Clarke	Leadbetter & Gilkes		04.50	05.10
	L	F/S Harrison	Wallace & Mason			06.00
14	M	Sgt Misbet			05.40	06.00
	N	Sgt Temple.				06.50

SOLO

Sgt Easterbrooke 19.00 - 20.00 Sgt Smith 20.10 - 21.15

INSTRUCTIONS

1. Night Flying will not be cancelled before 23.00 hours, even if weather is not suitable for flying prior to that time.
2. All trainees are to report to the Plotting Office 30 mins. before take-off.
3. All pupils detailed for flare path duties are to report to the Duty Pilot at 15.00 hours, and to the A.C.P. at 17.30 hours.
4. Flares to be laid and lit by 18.30 hours.
5. No. 5 Target is open unless a RED Aldis lamp is shown, meaning - GO HOME, or WHITE - WAIT, followed by GREEN - CARRY ON after WAIT.
6. No wind is to be found on Targets No. 4 & 5.
7. Leader will fire a GREEN Verey cartridge when he is ready to bomb.
8. On targets No. 4 & 5, leader will show DOWNWARD identification light, and follower will show UPWARD identification light.
9. "N" Flight will provide 8 aircraft and 4 reserves tested for night flying.
10. At the termination of night flying, flare path party is to replace the flares and hurricane lamps in the hut in an orderly manner. Flares will be placed on the shelf, and lamps hung on the nails provided. Electric cables will be wound on their appropriate drums in the Control Van - 100 yards lengths on left, and 50 yards lengths on right. The A.C.P. will ensure that the same number of flares and lamps are returned ~~afterwards~~ as were issued.
11. Officer i/c Plotting Office will report to the Night Flying Flight at 17.15 hours, to determine Wind Speed and Direction by Three-Course method.
12. Pyrotechnics are to be returned to the Pyrotechnic Store, key of which is kept in the Control Tower.
13. Unserviceable equipment is to be noted in the Watch Hut diary.
14. Pupils are to draw their parachute harness from the Parachute Store before 18.00 hours, and will return them when their night flying duties are completed.
15. Before take-off, R.T. communication is to be established with the Ground Station-(AVON 11). Remote Control is to be left in the RECEIVER position, unless it is necessary to relay messages to the Ground Station or other aircraft.
16. Signals - Permission to take off and land will be given from the Control Tower.

(G.R. BOLES) S.L.
O.C. Flying.

Course .92.

Final Bombing Written Examination.

All questions to be attempted.
Marks allotted as indicated. Time Allowed.....3 hours

No.1 (20) (a). Sketch the trajectories of a high and low T/V simultaneously released from the same uniformly moving aircraft and indicate their respective Trail Distances. (5 marks)
(b). How is the location of a bomb burst with relation to the point of release determined by the Course-Wind Analysis? Illustrate your answer with a diagram. (5 marks)
(c). What is meant by Track of Point of Aim? When does it coincide with the track of the aircraft? (5 marks)
(d). Which height scale would you expect to be the longer, one for a 4lb. Incendiary bomb or one for the 500lb. Armour Piercing bomb? Explain your answer. (5 marks)

No.2 (10) (a). How is the Triangle of Velocities represented on the C.S.B.S? (3 marks)
(b). Why must a bombsight be levelled when in use in level bombing? (3 marks)
(c). Define Trail Distance. How is it allowed for in the C.S.B.S? (4 marks)

No.3 (25) The diagrams on the attached sheet show targets and bomb bursts. Taking the top of the paper as North the headings of the A/C. are (i). 360, (ii). 090, (iii). 180, and the wind velocity is 180/25 m.p.h. On the attached sheet state which groups of errors are present and tabulate the possible causes. NOTE: ALL THE ERRORS ARE SYSTEMATIC.

No.4 (20) Navigators Only
(a). What is the Test Triangle for the C.S.B.S? (5 marks)
(b). What is the alignment test for the C.S.B.S? (5 marks)
Air Bombers Only
(a). How would you test the moving parts of the C.S.B.? (5 marks)
(b). How would you test the wind gauge bar for distortion and slackness at the hinge? (5 marks)
Navigators and Air Bombers
(c). What is the Backlash test for the C.S.B.S? (5 marks)

No.5 (15) (a). When would you use and how would you initiate the following pyrotechnics: (i). Marker Marine A/C. Mk. (ii). Smoke Generator No.6. (10 marks)
(b). Where would you expect to find the cartridge signal 1888 1" Red? Under what circumstances would you use it? (2 marks)
(c). What is the effect produced by (i) Flame Float Mk 11, (ii) Smoke Float No 3, (iii) Aluminium Sea Marker Mk V? (3 marks)

No.6 (10) Sketch the body of the 2,000lb. A.P. bomb and indicate the colour markings and stencilling. State what each means. (10 marks)

No.7 (10) (a). Sketch the No.38 Tail Pistol and name the parts. (5 marks)
(b). Explain the action of the No.38 Nose Pistol. (5 marks)

No.8 (10) Tabulate the general precautions to be observed when fusing bombs.

No.9 (15) (a). Explain how you would jettison "Safe" a mixed load of 40lb. G.P. bombs carried in a Small Bomb Container and 500lb G.P. bombs carried on Universal Carriers. All switches used must be mentioned. (5 marks)
(b). How would you load the Universal Carrier No.2 with a 500lb M.C. bomb ready for an immediate take-off? (5 marks)
(c). What is the Adaptor Box? Explain its use briefly. (5 marks)

No.10 (15) (a). Give the sequence of operations and the switches used if you were stick bombing underbthe following conditions: Interval between release of bombs 1 second and height 15,000 ft. (10 marks)
(b). What are the two lights on the Automatic Bomb Distributor and Type F 16 Point Selector Switch Box? Explain the purpose and function of each. (5 marks)

No.31 Bombing & Gunnery School
Royal Air Force
PICTON

504

17th. December 1