

Martin Hydraulic Upper Deck

MARTIN 250CH-1 & 3

The Martin Hydraulic Upper Deck Turret is the standard Navy installation for many flying boats. It can swing its guns a full 360° and protects the whole upper area of the plane with its deadly efficient cone of fire. There are several models, which for the most part are the same. The Martin 250CH-1 is used in a Martin "Mariner", and the Martin 250CH-3, in the Consolidated "Coronado". The Martin 250CH-2, which is almost identical with the 1 & 3, is the tail turret of the PBM-3D, and will be covered in a supplement to this section.

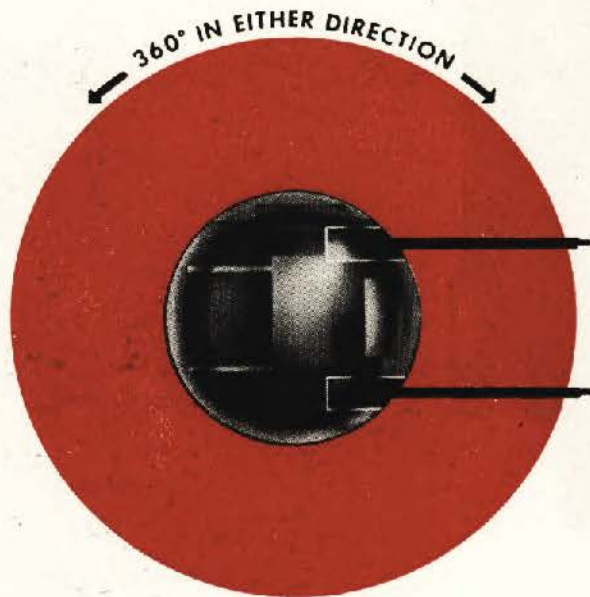
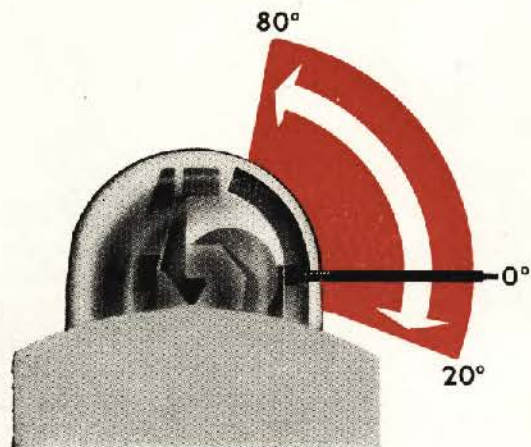
Facts and Figures

POWER

The Martin 250CH turrets operate hydraulically on pressure built up by a hydraulic pump driven by a constant speed electric motor.

SIGHT

Its sight is a standard MK 9 sight, fully described in the introduction of this section.



ELEVATION

The guns may be raised 80° above the horizontal and depressed 20° below the horizontal.

ARMOR

The armor protection on the front of the turret consists of three sections to shield the gunner from enemy fire in any direction in which he points the guns: $\frac{1}{2}$ " armor plate on the sight bracket for face protection, $\frac{1}{2}$ " armor plate for protection of the body, and $\frac{3}{8}$ " armor plate for protection of the ammunition magazines.

AZIMUTH

The turret can move 360° —a full circle—in azimuth.

STOWING POSITION

The stowing position is 0° elevation and 180° azimuth, guns pointing straight aft.

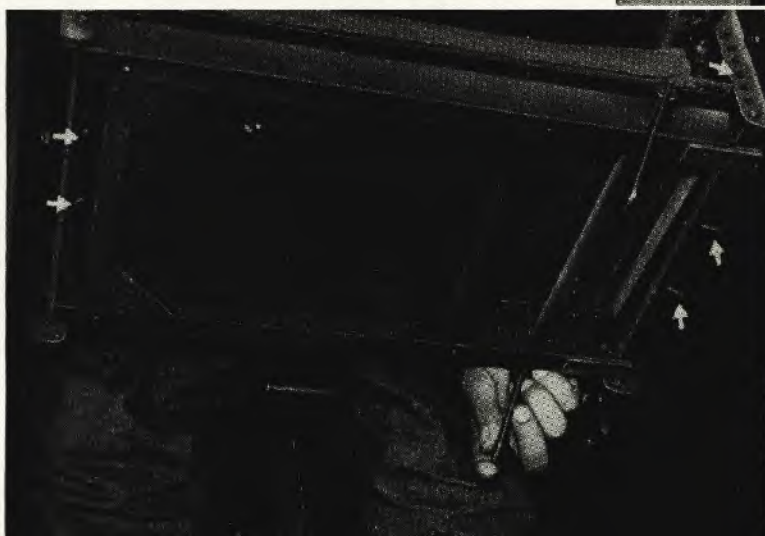
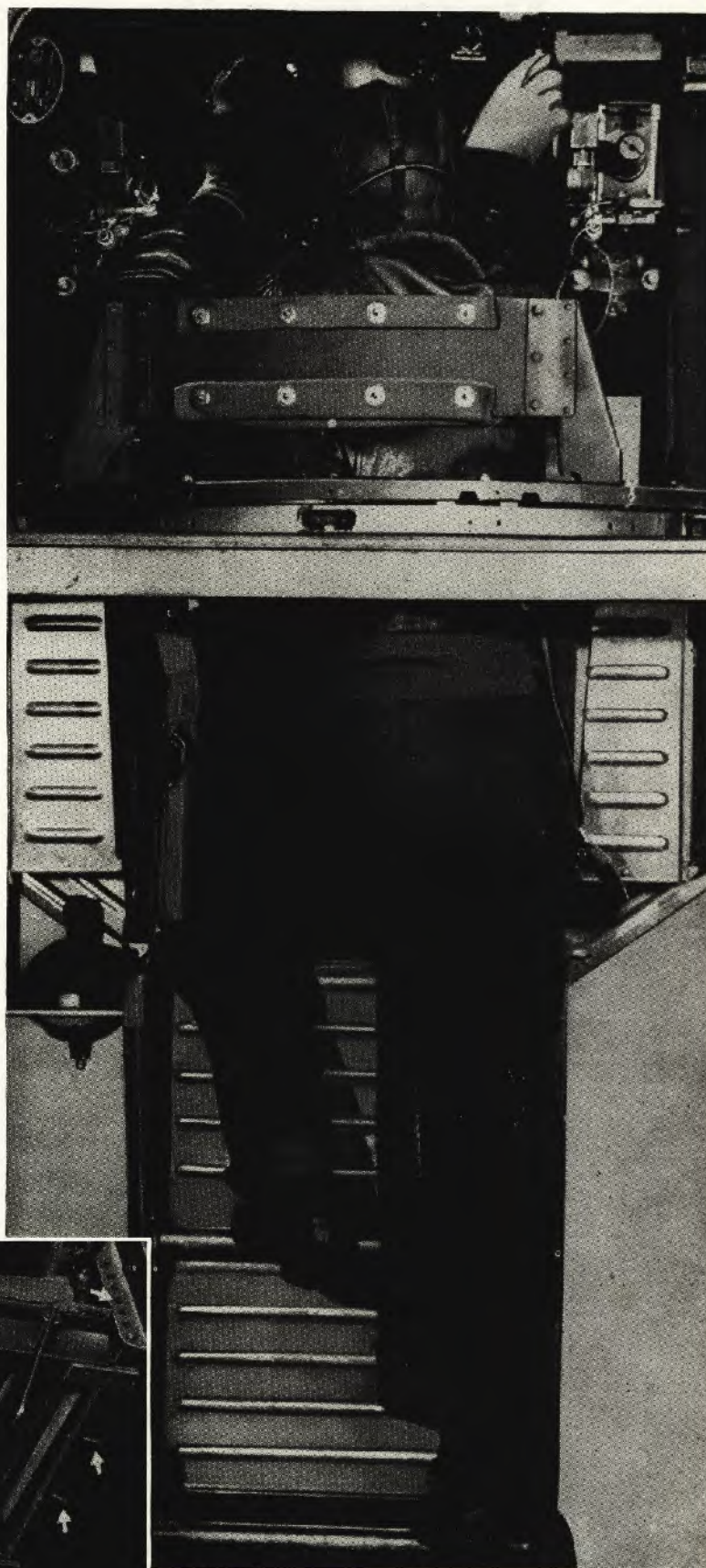


Getting In

The Martin Hydraulic Upper Deck Turret is one of the easiest to enter. First of all, before you get in make sure that the **deck turret switch** has been turned to the **on** position on the flight engineer's panel. Just outside the turret on a junction box, conveniently located on a bulkhead, is a **switch** and a **red indicator light**, which provides for turning "on" or "off" the power to the turret. In the turret is a similar switch marked **main power** with a **red indicator light** directly below it. In turning on the power it is best to wait until you are in the turret, as the switch on the outside junction box is to be used for emergency purposes only.

Now enter the turret head-first from the rear of the ammunition box by climbing up the two steps, using a convenient portion of the structure of the turret as a hand grip to help you.

While standing on the top of the ammunition box covers, reach down and pull the seat up until it locks over the right hand seat support bar. Then look through the **sight** to see if you are at the proper height. If you are not, get out of the turret and adjust the seat. This is accomplished by pinching together the **pins** in the seat support bars, which are located on each side of the seat, and raising them to the next holes above or below. On completion of this, climb back into the turret. Fasten the safety belt and you are now ready to operate.



Operating the Turret



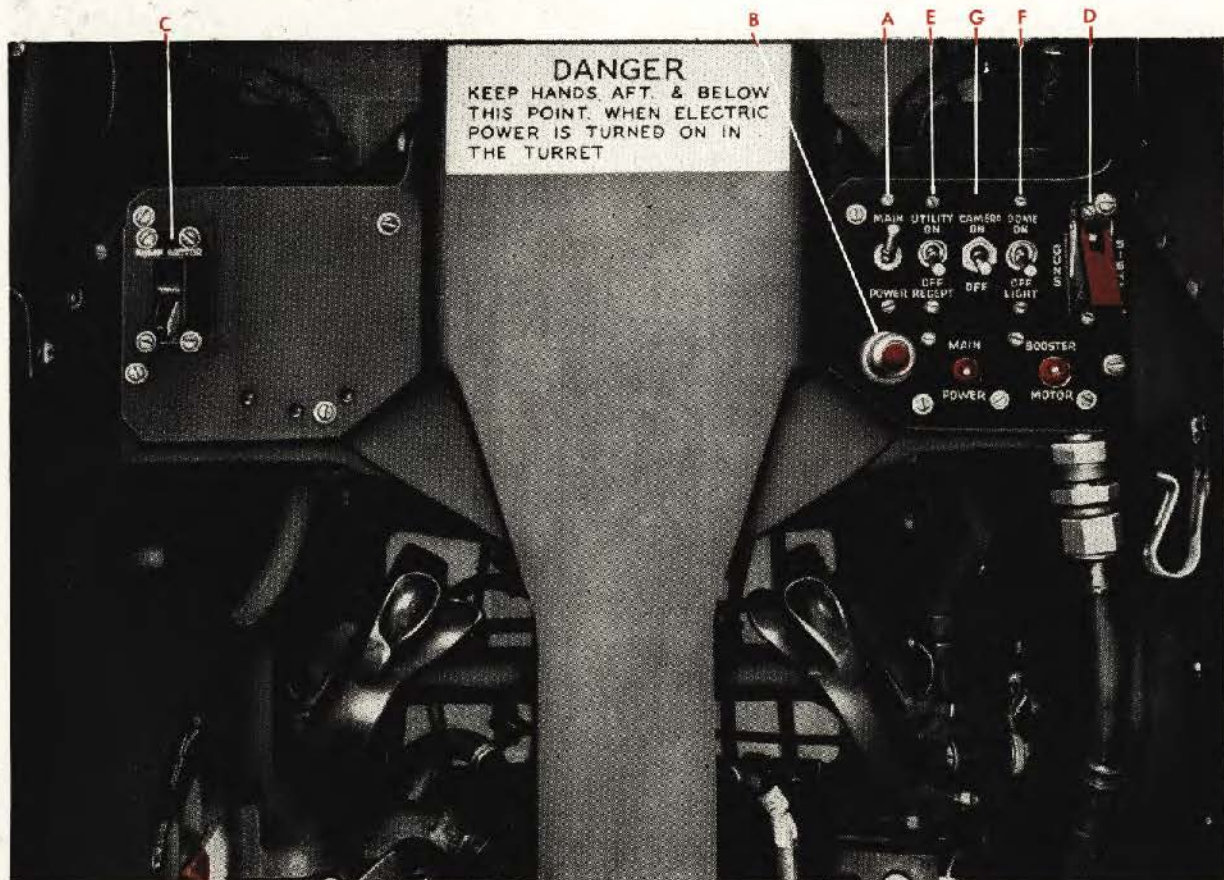
... Where to Find the Controls

... How to Use Them

Putting the Martin 250CH Turret into operation is a relatively simple job.

First of all, look down over your right foot and you will see a **low-pressure gauge** which should read **25 lbs. to 30 lbs.** pressure. It is very important that this pressure be present as it insures smooth operation of the turret.

Directly in front of you on the right side is the **control panel**. On it you will see a switch marked **main power (A)** with a **red indicator light (B)** below it. Flick this switch to the **on** position and the red light will light up on the control panel and on the junction box just outside of turret, indicating the power is on.



On the left side of the control panel you see another switch all by itself, marked **pump motor switch** (C). Raise this to the **on** position. Lift the little red plastic cover on the right side of the control panel and flick the **gun-and-sight switch** (D) to the **on** position.

The **control handles** are located below and back of the breast plate in which the control panel is mounted.

To start the pump motor use the bottom edges of your hands to press down the two **safety switches**. When the motor is running, the handles will automatically go to neutral position. For this reason it is best to press the safety switches down before grasping the hand grips of the control handles. If this is done, the control handles will move to the neutral position without moving the turret. If the control handles are in any other position than neutral and the safety switches are closed, the turret will start, causing immediate and violent action. Either safety switch will operate the turret.

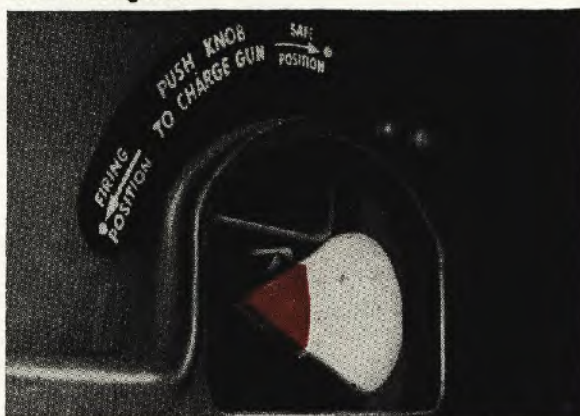
Depressing the safety switches also turns on the **sight** and provides power to the **booster motors** so that they will operate when the guns are fired.

To adjust the brightness of the **sight** to light conditions use one hand to hold the control handles, keeping the safety switch depressed, and turn the rheostat on the sight.

To operate the turret turn the control handles in the direction you desire the turret to move. For azimuth (right or left) the control handles are operated exactly like those of a bicycle. For elevating the guns move the upper part of the control grips backward; and for depressing the guns, move the top portion of the control handles forward. Don't jerk the controls—move them smoothly and deliberately.

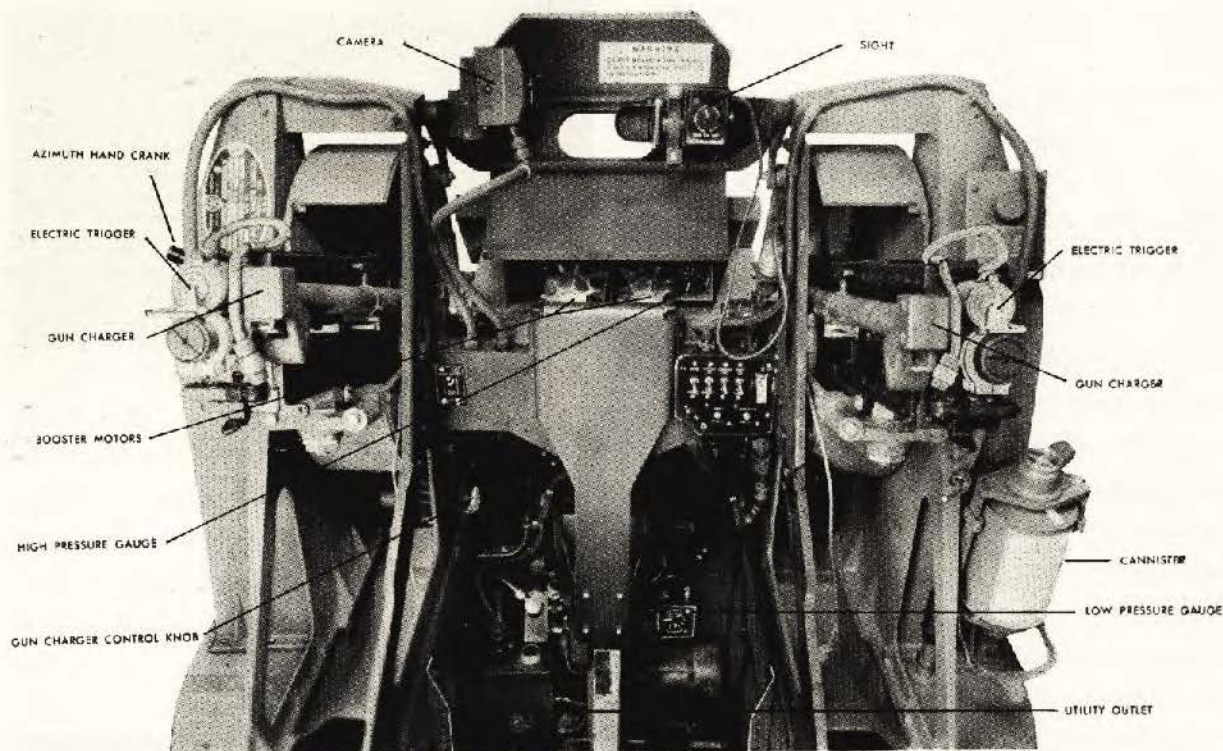


Above the control panel, and right center, is the **high pressure gauge**. As soon as the pump is operating, check to see if it reads the desired **750 lbs.** pressure. While operating the turret, from time to time check this gauge to see that the proper pressure is maintained. Right under your index finger on both control handles are the **triggers**. Either trigger will fire both guns.



Next to your left knee is the hydraulic **gun charger control knob**, which operates the **gun chargers** located on the inboard side of each gun. To charge the guns turn the control knob to the **Firing** position. Depress the control knob sharply. Both guns will be charged at once and ready to fire. If the control knob is turned to **Safe** before depressing, the gun bolts will remain in the retracted position, which provides access to remove a jam.





Using Auxiliary Equipment

The turret **oxygen system** is connected to that of the airplane through a swivel joint in the base of the turret. The system consists of a rebreather unit, a cannister, and a nose piece. The rebreather is mounted on the right side of the magazine under the expended ammunition container. The cannister is located on the outboard side of the right ejection chute casting and is connected by a flexible hose to the oxygen mask. However, you will find in many of the existing PBM and PB2Y airplanes that



the oxygen system has been done away with, because it is not necessary for these airplanes to fly at high altitudes while on patrol.

The cord to the **heating suit** is plugged into an outlet on the junction box, which is located directly above your left foot. This is turned on at the control panel by the **utility switch (E)**. The **inter-phone jack box** is attached to the right ejection chute casting. This is where you plug in your jacks for your headphones and throat microphone. On the front of the box is the "push-to-talk" button that operates the inter-phone system when you wish to speak.

Two **trouble lights** of the spotlight type are mounted on ribs from the top of the dome, one on either side of the escape hatch. A ball swivel joint on each light enables you to direct the light in any direction desired. The **dome light switch (F)** is located on the control panel.

Provisions have been made for installation of a **gun camera** on the left side of the sight. To put the camera into operation it is necessary to have the **camera switch (G)** and the main power switch "on", and the trigger and safety switch depressed.

In the event that the power fails, a **manual azimuth drive** is provided so that you may rotate the turret. The **drive crank** is stowed on a spring clip mounted on the aft face of the left ejection chute casting. Remove the crank from the clip and insert it in the hole on the right inboard side next to your right knee. This ties the crank directly into the azimuth gear mechanism. Turning the crank one way or the other moves the turret in azimuth. You will find the crank extremely helpful in testing the fire interrupter and boresighting the guns when a slow, carefully controlled amount of azimuth movement is necessary.



Before going back to power operation be sure to remove this azimuth manual crank. If you have it engaged it will whirl around and may break your hand or leg.

No manual elevation mechanism is provided in this turret. However, in models which are about to be produced, manual operation will be provided for both elevation and azimuth.

Getting Out

Getting out of the turret you will find just as simple as getting in. First of all, move the guns to the stowing position—guns at zero elevation and 180° azimuth, pointing straight aft.

Turn off all switches. Disconnect all auxiliary units you have been using.

Brace yourself against the back of the seat and reach down on your right side and depress the seat release. The seat will then swing down out of the way. All you have to do now is to climb down two steps and you are out of the turret.



Emergency Exit

If it is necessary for you to get out of the turret in a hurry, an emergency exit is possible through an escape hatch in the plastic dome. Two plastic handles are located on either side of the hatch and by turning them a quarter of a turn, the hatch will fall inboard. By standing on the seat you will find it an easy job to crawl out of the top of the turret.



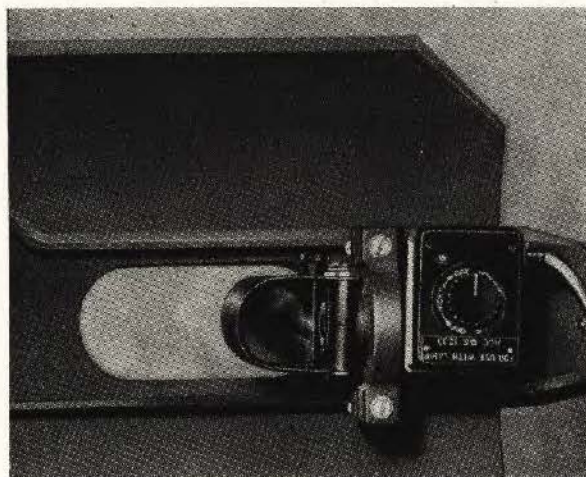
Preparing the Turret for Combat

You have now read how to get into the turret, how to operate the controls and auxiliary units, and how to get back out. With this information you should have no trouble in taking over the turret and operating it in combat.

To be a specialist in the Martin 250CH you will need additional instruction on how to get the sight and guns ready for a mission, harmonize them, and load ammunition. You will find this information in the following pages.

The Sight

The Navy Mk 9 sight fits into the gun sight bracket directly behind a ½" armor plate which protects your face. To adjust the sight, as it may be sometimes necessary in harmonizing it with the guns, make the adjustments on the sight head. For full instructions see the section on the Mk 9 sight in the general introduction.

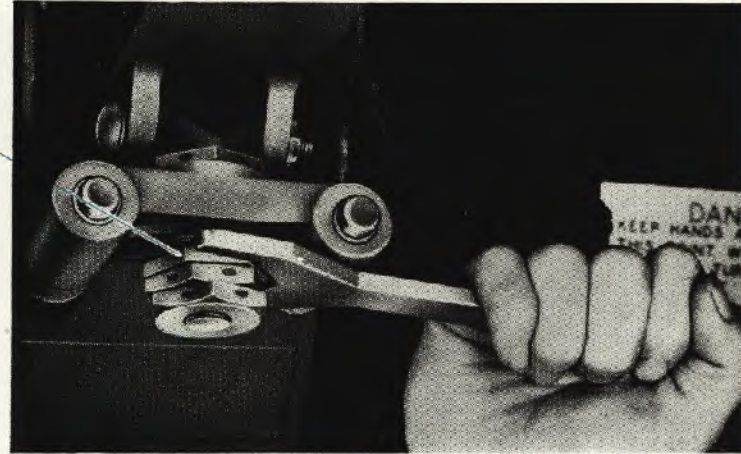


Adjusting The Guns



The guns are mounted in the Martin Ball to feed from the inside—the right gun feeds from the left and the left gun feeds from the right. Each gun is installed with an Edgewater E-10 adapter and is bolted to the front and rear mounts in the gun cradles.

The guns may be adjusted up, down, or sideways in their cradles by means of an adjustment nut assembly which is locked into place by jam nuts. An elevation adjustment nut controls the up and down movement. An eccentric nut controls the sideways motion.

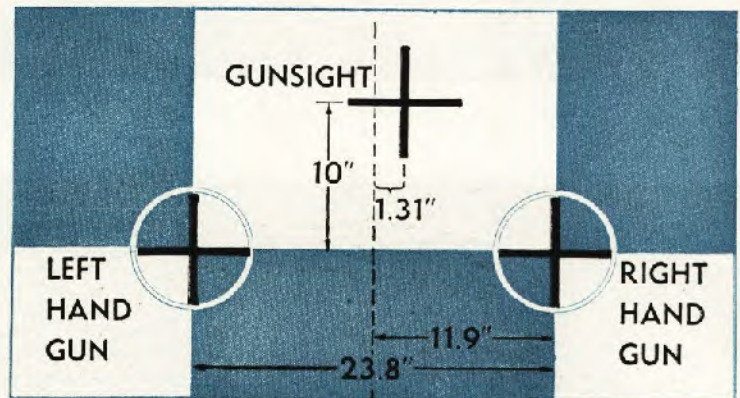


Harmonizing the Guns and Sight

There are a number of ways to harmonize the guns and sight in the Martin Hydraulic Deck Turret. The exact procedure will be defined by the Squadron Gunnery Officer. A handy method is to line up the sight and boresight the guns on some small object, such as a tree or chimney, at least 1000 yards from your plane. To do that remove the back plates and bolts from both guns, or use a boresight tool so that you can look through the gun barrels without removing the parts. Turn the turret until the guns point at the object you have selected.

Now line up the sight, using the azimuth hand crank to move the turret until the dot of the sight is squarely on the object. Don't move the turret again. Now boresight through each gun barrel to line up each gun. Adjust each gun by its rear mount adjustment nuts until the spot the sight is centered on is exactly in the center of each gun bore. Sometimes the amount of adjustment in the rear mounts of the guns may not be enough. In that case, boresight each gun on the small object selected. Then you must

make adjustments on the sight head to line up the dot on the same object.



Another method of harmonization is to line up the sight and guns on a special pattern stand, or template, such as the one illustrated here. Set up the stand as level as possible at least 50 yards from the side of the plane. Center the guns in their mounts. Then boresight each gun on the pattern stand and center the sight on the sight cross, using the standard technique described in the Sights and Sighting section of this manual. Both methods described here are parallel harmonization.

Loading Ammunition



The Martin Hydraulic Upper Deck carries its ammunition in two built-in magazines, separated by a steel partition and mounted under the feet of the gunner. These double magazines are loaded through sliding removable doors on top and hold 600 rounds of .50 cal. ammunition for each gun. The top of the ammunition box and the removable doors also serve as a foot-rest for the gunner. To load the magazines:

1. Remove the foot plates at the top of the ammunition box. This is done by pulling the spring-like pin under the foot-rest panels and then skidding the foot plates aft and off.
2. Remove the forward and aft pins of the feed chute. Remove the chute.
3. Load the ammunition belts by flaking them back and forth across the magazine.
4. When ammunition boxes are full reinstall the feed chute and its pins.
5. Lower a wire hook or an ammunition thread sling down the top of the booster feed and through the feed chute attaching it to the ammunition belt in the magazine.
6. Reinstall foot plates at the top of ammunition box.
7. Pull each ammunition belt up through the chutes until one or two rounds of ammunition are engaged in the booster sprockets.
8. Lift the cradle cover and gun cover. Pull enough ammunition to be loaded into the guns.
9. Close the gun covers and cradles.

Removal of Empty Cartridge Cases and Links

On either side of the seat, attached under the azimuth track, are the expended ammunition containers—one for each gun. To remove the empty links and cartridge cases, slide down the access doors on the back of each container after pushing in the latching catches on the access doors. Clean out the empty cartridge cases and links. Replace the access doors.

Pre-Flight Routine

... Follow Step by Step

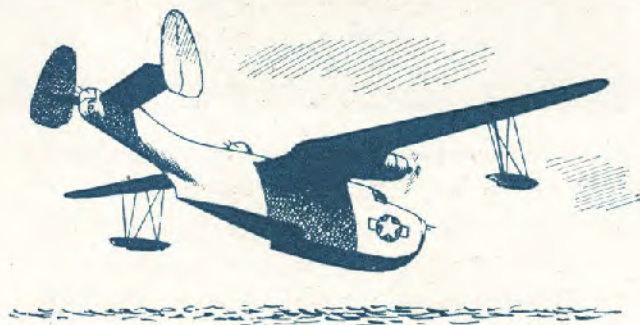
1. Install the barrels and oil buffer groups in the guns—leaving out the bolts and back plates.
2. Check harmonization of the guns and sight by boresighting on pattern stand or some other object 1000 or more yards away.
3. Make sure the bolts are assembled properly to feed from the right for the left gun and from the left for the right gun. Install bolts and replace back plates on both guns.
4. Try to rock the guns in their mounts to make sure they are securely mounted. Check to see if the adjustment and jam nuts are properly safetied.
5. Check filler valve. It should be in the "RUN" position and safety wired.
6. With the pump in operation, operate the gun charger valve knob in both "SAFE" and "FIRE" positions.
7. Inspect the hydraulic system and lines carefully. This should be done with and without the pump operating. If there are any leaks, report them immediately.
8. Inspect electrical leads and flexible conduits (Breezes) to determine if they are frayed or damaged.
9. Check all Cannon plugs to see that they are properly seated and screwed up tight.
10. Check oxygen connections to be sure they are tight.



11. Make sure plexiglas dome and escape hatch are properly secured and clean.
12. Check low pressure gauge to see if you have 25 to 30 lbs. pressure required.
13. Operate the turret to determine if the high pressure gauge reads required 750 lbs.
14. Check ease of operation in elevation and azimuth. Stop turret with pump running (control handles in neutral). Check for "creep."



15. Check for "line knock" (air in hydraulic system) while operating turret in all extremes. If any is noticeable, report it to maintenance man.
16. Operate the turret in elevation to determine if the limit stops are functioning properly.
17. With the guns completely depressed, carefully rotate the turret to determine if the structural interrupter keeps the guns from swinging into the fuselage.
18. Insert a test light in place of electric trigger control, and with triggers depressed, rotate the turret across the portions of the plane into which the guns could fire. The test light will go out in this area. With a boresighting tool, check the distance from the surface the interrupter cuts out.
19. Turn on the sight and gun switch, depress the safety switch, and rotate the sight rheostat from dim to bright to adjust the brightness of the reticle to existing light conditions. Make sure the reflector plate of the sight is clean.
20. Plug in your headphones and microphones to test if your crew mates can hear you and you can hear them.
21. Plug in your heating suit and make sure it begins to heat.
22. Make sure both trouble lights are operating.
23. Inspect all ammunition belts to determine that the rounds are in good condition and properly belted.
24. Check booster motors by tipping them toward the guns. Make sure they cut on and off sharply without lagging.
25. Load ammunition magazines. Feed the double link up over the booster motors' sprockets, and press the first round into the feedway of each gun. You will not charge your gun until you are in the air and so ordered by your plane captain.

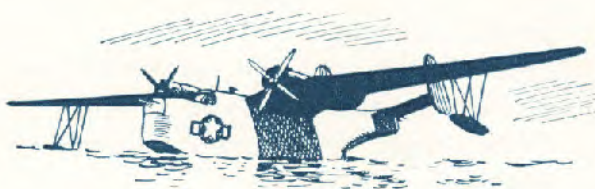


Before Landing

1. Run the turret to its stowed position—0° elevation and 180° azimuth, guns pointing straight back.
2. Clear the guns by lifting the gun covers, removing ammunition and charging them twice.
3. Remove all ammunition from feedway; check all switches and make sure they are off.
4. Disconnect any auxiliary equipment that you have been using.
5. Get out of the turret.

After Landing

1. Remove all ammunition from chutes and magazines.
2. Open access doors on the expended ammunition containers on either side of the turret and clean out empty cartridge cases and links. Replace the access door on completing the job.
3. Field-strip the guns by removing their working parts. Clean and inspect gun receivers, then detail-strip the parts you have removed from the gun, cleaning them and making a thorough check of their condition. Do not leave excess oil or cleaning fluid in turret.
4. Report any malfunction of turret or guns noted on the mission.





Martin Hydraulic Tail

MARTIN 250CH-2

There is little difference between the Martin 250CH-1 and 250CH-3 Deck Turrets and the Martin 250CH-2 Turret used in the tail position of the PBM-3D airplane. Both types are operated exactly the same. The information on the following page will outline the major differences between the two types.

AZIMUTH

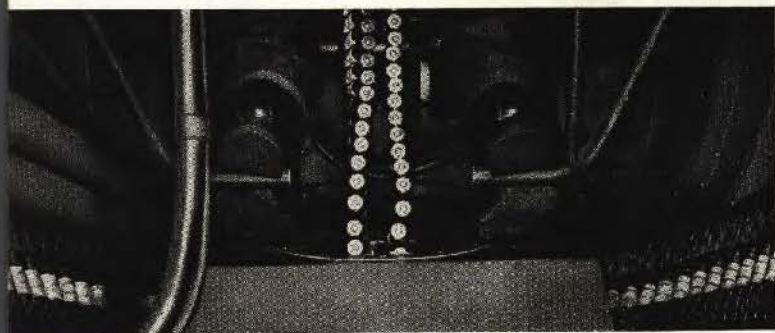
The Martin 250CH-2, being a tail turret, is provided with an azimuth movement of 75° on either side of the center line of the ship.



MARTIN TAIL TURRET

As the Martin 250CH-2 is a tail turret, never remain in it during takeoffs and landings. Your additional weight in the tail would put undue stress on the plane besides making it unbalanced.

To enter the turret crawl in on your hands and knees. When you are inside, straighten up, and pull the seat up until it locks over the right



hand seat support bar. Look through the sight to see if you are at the proper height. If not, adjust the seat as you would in the Martin 250CH-1 or 3 Deck turret. In this turret you do not place your feet on the top of the magazines as you would in the deck turret, but on foot brackets.

Keep your feet on these foot brackets

ELEVATION

In elevation it can raise its guns 65° above horizontal and depress them 45° below horizontal.



at all times while operating the turret or it is possible that you may get them jammed between the turret and the structure of the ship.

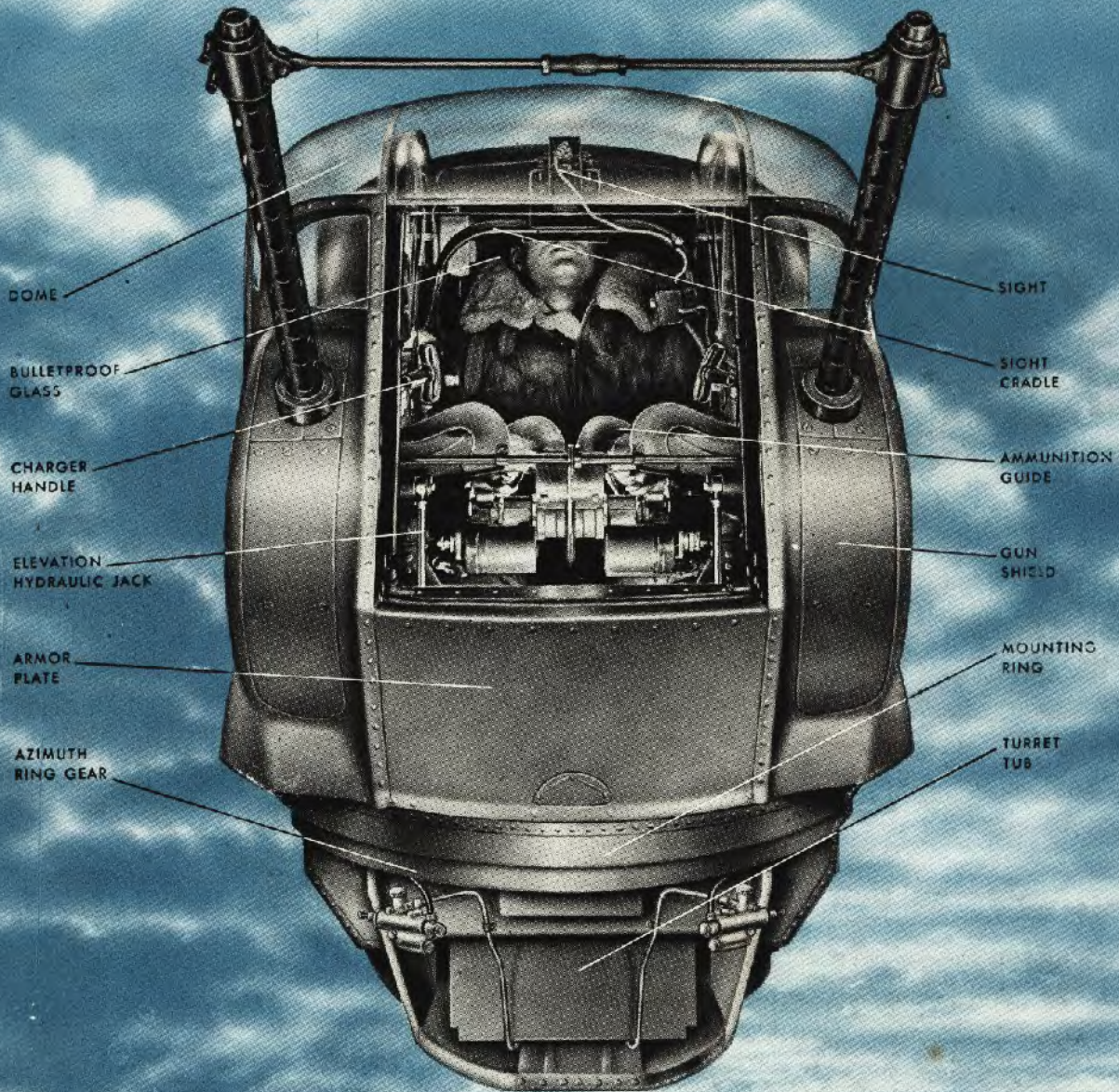
To get out of the turret first run it to its stowing position — 0° elevation and 180° azimuth — guns pointing straight aft. Then crawl out of the turret in a manner similar to that used in entering. No magazines are provided in the turret, but they are located in the hull of the airplane, one on either side. Each of these magazines holds 1000 rounds. The ammunition travels along both sides of the hull on roller tracks and enters the turret between the gunner's feet. The empty cartridge cases and links are carried overboard through chutes.

The check off routine for PRE-FLIGHT on both Martin Deck and Tail Turrets for the most part is the same with the following substitutions:

Pre-flight

16. Operate the turret in both extremes of elevation and azimuth to check the limit stops.
17. Disregard this check, as no structural interrupter is provided in the tail turret.
18. Disregard this check, as no fire interrupter is provided in the tail turret.

BEFORE-LANDING and AFTER-LANDING procedures are exactly the same.



THE CONSOLIDATED TAIL

CONSAIR 250CH-3 OR M.P.C. 250CH-6

The Consolidated tail turret is a double stinger in the tail of the PB2Y-3 Coronado and the PB4Y Liberator. In some Liberators it is also used as a bow turret. It is a versatile gun mount providing a large cone of fire.

There are two models—the original Consair 250CH-3 and the new MPC 250CH-6, which is now in general use and has some marked mechanical improvements.

In operation the two models are basically the same.

Facts and Figures



AZIMUTH

The turret moves in azimuth about 75 degrees to either side of the ship's centerline — from almost straight out to the left to almost straight out to the right.

SIGHT

Its sights is the MK 9 reflector described fully in the Sights and Sighting section of this manual.

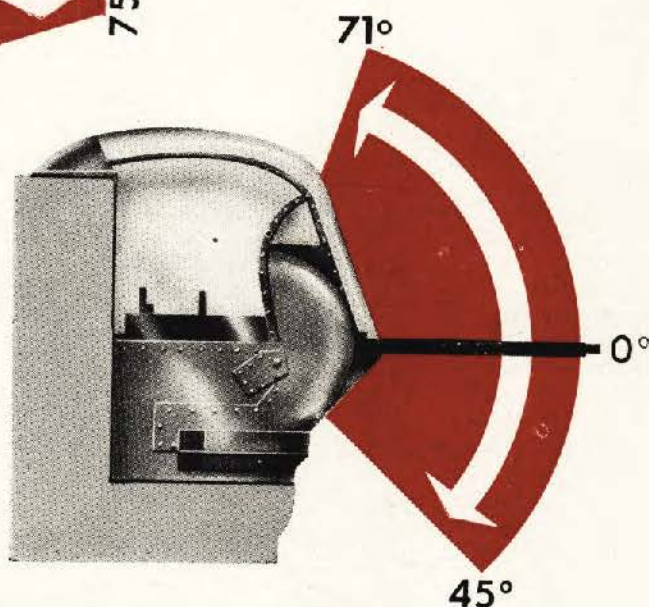
ARMOR

A bulletproof glass panel, $2\frac{1}{8}$ inches thick, protects the gunner in front. Directly below it is a $\frac{7}{8}$ -inch armor plate panel, and to the right and left of the gunner's knees are two more small panels, $\frac{3}{8}$ inch thick.



POWER

The Consolidated Tail operates hydraulically, on pressure built up by a hydraulic pump driven by a constant speed electric motor.



ELEVATION

In elevation, the turret guns can be lowered and raised from 45 degrees below the horizontal level to 71 degrees above horizontal.

STOWING POSITION

The stowing position for turret and guns is 180 degrees in azimuth and 60 degrees in elevation—guns pointed back from the tail and two-thirds of the way between level and straight up.

Getting In

When you step into the Consolidated Tail for the first time, approach it with care. Unless the turret is properly locked, it may swivel and trap a man trying to go through the doorway. The method of getting in illustrated on this page is the only safe way—follow it step by step.

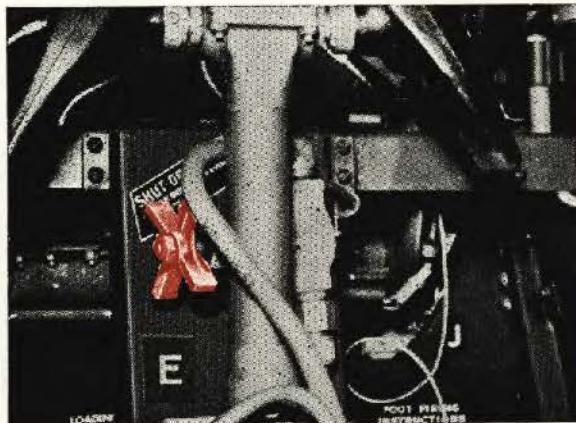
And remember, as you get into the turret for your first look around, that ordinarily you would enter only after the bomber is in full flight, and would get out before the landing. Quick changes of speed during takeoffs and landings make any tail turret an extremely dangerous place to be at those times.

1

Turn on the **main power switch** just outside the turret on the fuselage of the plane.

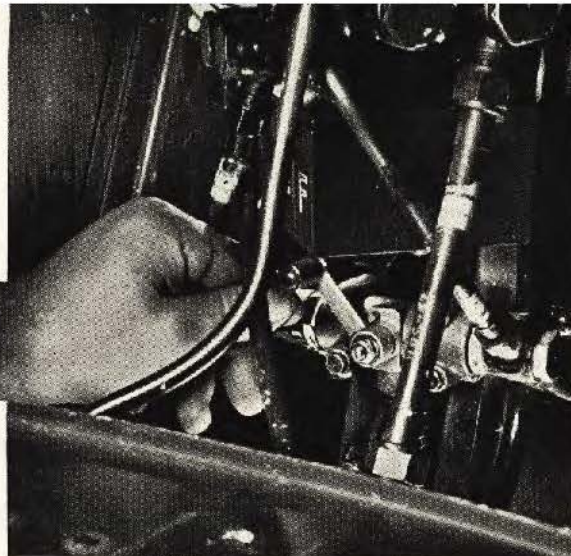


2 Open the turret doors.



3

Reach into the turret and make sure that the **main shutoff valve**, a red spindle knob to the left center, is closed. The valve should be turned all the way in. If it is open, a mere touch on the control handles might set the turret moving and trap you in the doorway. Always make sure the main shutoff valve is closed before entering or leaving the turret.



4

Make sure the **azimuth emergency release valve** under the seat is closed.

5

Make sure the **elevation bypass valve**, a small handle below and to the left of the control unit, is closed. The handle should be up.



6 Grasp the two handles just above the doorway, and, chinning yourself, swing both feet straight into the turret pit. Then get into the seat.

7

Pull down on the door cable, by grasping the red knob on your right, to close and lock the doors behind you. Be sure the doors are tightly latched.





8

Remove the **azimuth mechanism lock** on your right and the **elevation mechanism lock** on your left. Put the locks in their clips on the turret wall



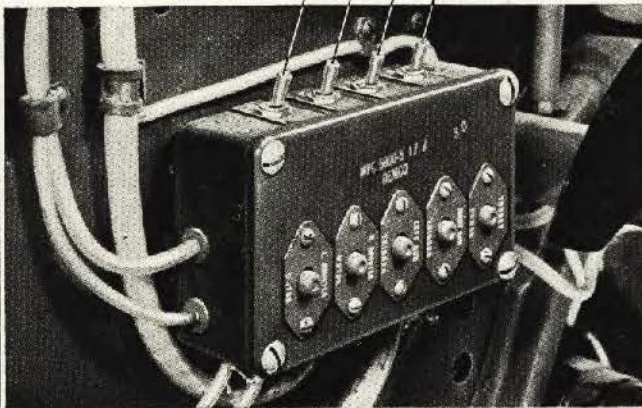
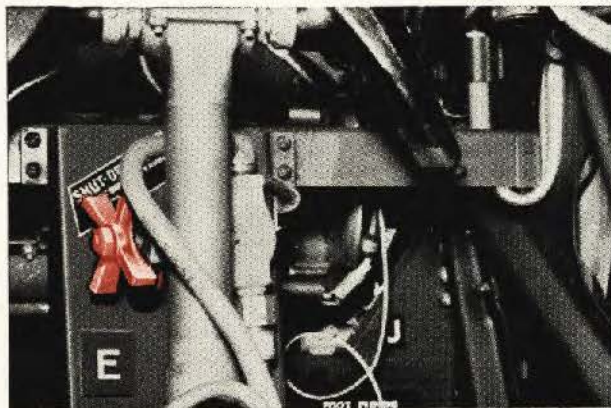
Operating the Turret

... where to find the controls

... how to use them

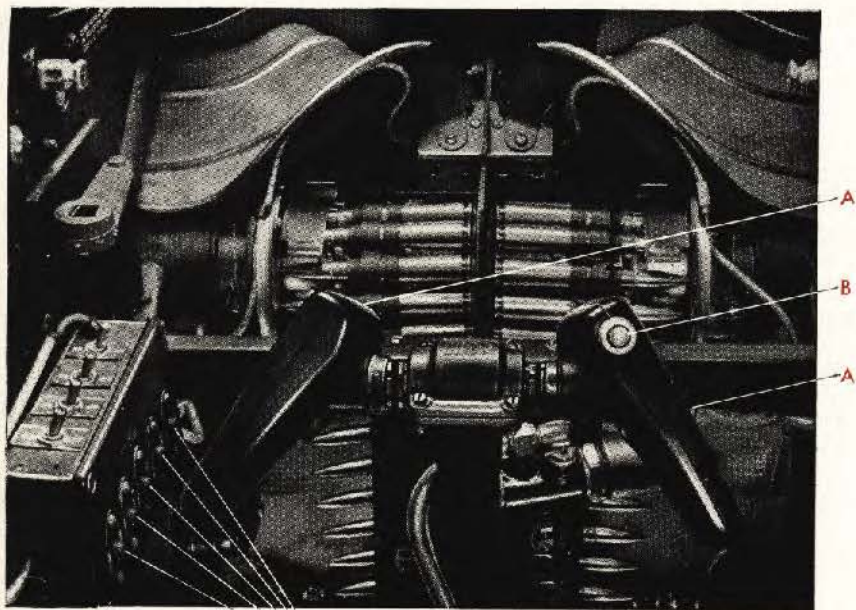
Close at hand, as you sit in the Consolidated Tail, are all the switches, valves, and controls. They are easy to get at and easy to use. But be sure to turn on the switches and open the valves in the order shown here.

1 Open the **main shutoff valve**.



- 2** Turn on the **power switch** (A) on the junction box beside your left knee.
- 3** On this same panel flip on the **booster motor switch** (B) and the **trigger switch** (C). If you are using a gun camera, flip on the **gun camera switch** (D).
- 4** Turn on the **sight rheostat**, near your left shoulder, and rotate it to adjust the brightness of the light in your sight.





5

Grasp the control handles directly in front of you, and you are all set to go. To move the turret, turn the handles just as you would steer a bicycle—to the right to go right, left to go left. Press down on the heels of the handles to raise the guns. Pull up on them to lower the guns.

The other controls you will use in combat are close at hand.

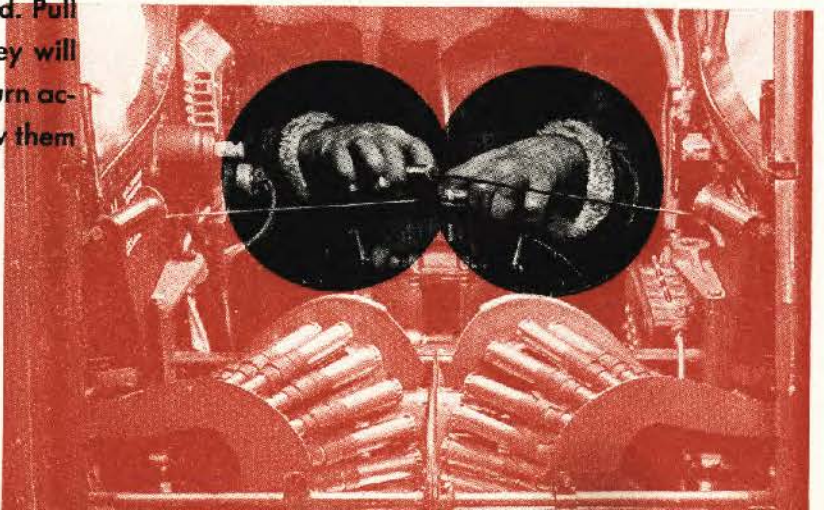
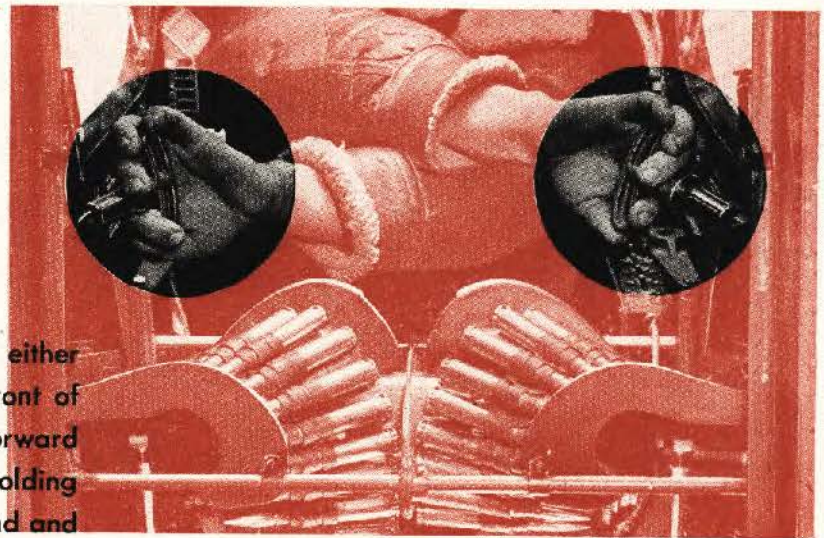
The **triggers** (A) are on the control handles, right under your index fingers.

The **push-to-talk button** (B) that opens the interphone system for you to speak is on the right handle, under your thumb.

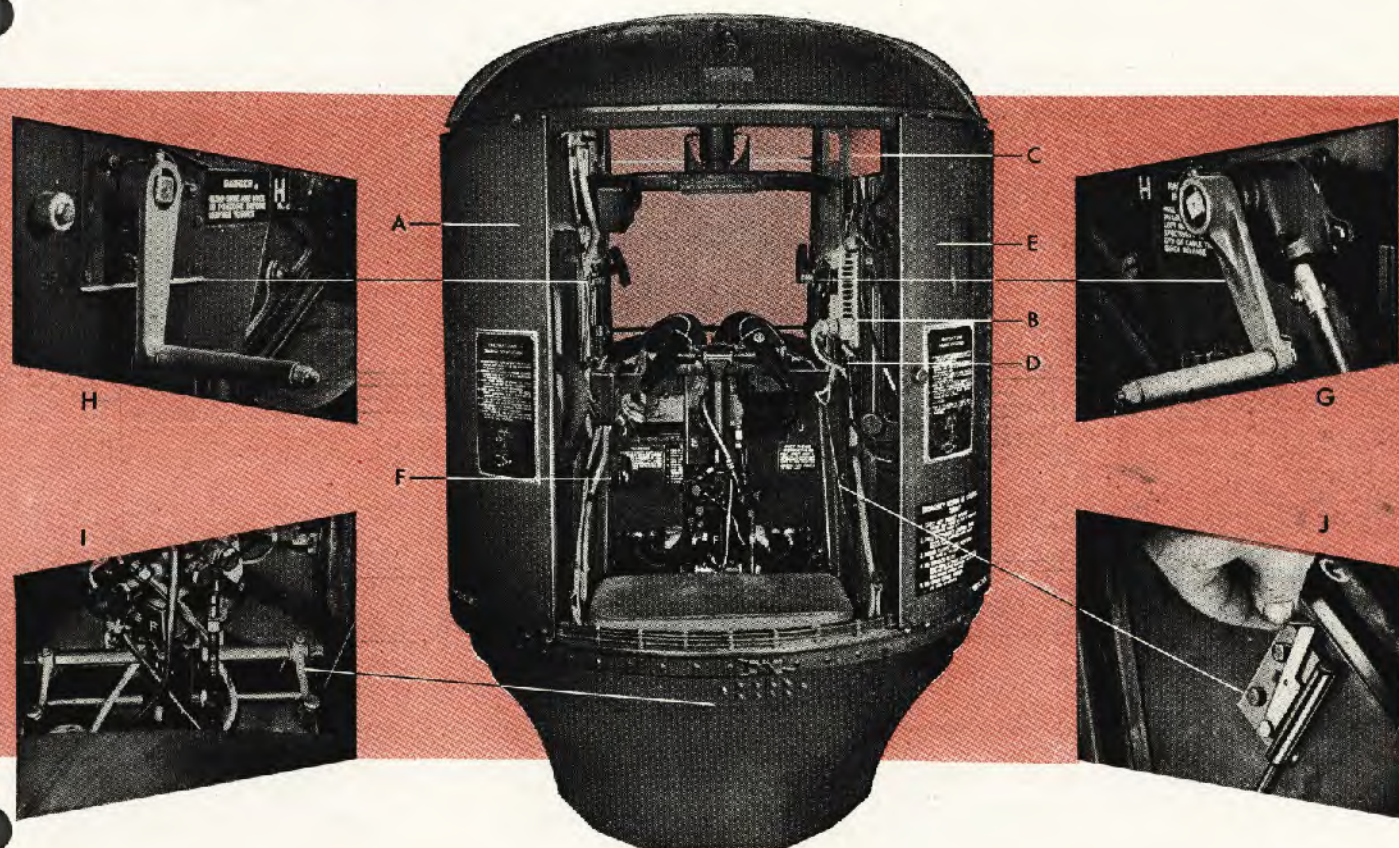
A set of **reset buttons** (C) protecting the main electrical circuits is mounted on the side of the junction box—each button labeled with the name of the circuit.

6

The **charging handles** are on either side of the bulletproof glass in front of you. To charge the guns, reach forward and grasp the handles cross-arm, holding the left handle with your right hand and the right handle with your left hand. Pull back on them sharply as far as they will go. Don't ride the cables on the return action. Still holding the handles, allow them to snap back on their own power.



Using the Auxiliary Units



You will find a demand type oxygen regulator (A), with hose connection for your mask, near your left shoulder. The oxygen supply is drawn from the ship's central tanks.

The heated suit plug-in (B) is mounted on the right wall of the turret enclosure near your right shoulder. The interphone jack box (C) is on the right wall of the turret, too, near your cheek; from it lead the interphone jacks (D).

A trouble light and switch (E) fit in a holder in the upper right-hand corner of the turret enclosure. A warning bell (F) on the left forward wall of the turret is connected with the pilot's compartment—he will ring it when he wants to land, notifying you to get out of the turret.

Shafts for manual operation of the turret in emergencies are on the right and left side of

the turret seat—the right shaft (G) for azimuth movement, the left (H) for elevation. The two hand cranks are stored in clips on either side. At your feet are two foot-firing pedals (I), with a foot-firing mechanism lock (J), which allow you to fire the guns in manual operation.

To change to manual operation:

- 1 Close the main shutoff valve. Open the bypass and emergency release valves.
- 2 Slip the hand cranks on the manual shafts.
- 3 Pull the foot-firing mechanism lock up into its OPEN position.

Always push the foot-firing mechanism lock DOWN into its locked position after manual operation. **Never charge the guns unless this lock is down.**

Getting Out

When you get out of the turret—before the landing if you are on a flight—be as careful as you were when you got in. Remember that the doors can trap a careless gunner on the way out as well as on the way in.

First move the turret to stowing position—guns pointed back and to 60 degrees elevation. Then turn off the sight, trigger, booster motor, and main power switches on the junction box. Close the main shutoff valve, and replace the azimuth and elevation mechanism locks which you removed when you got in.

The turret is now locked in place. Open the doors by pulling the cable on your right and step out. Then close and latch the doors behind you and turn off the main power switch on the fuselage wall.



Preparing the Turret for Combat

With the practical data in the preceding pages, you could take over the Consolidated in combat. However, that will be only part of your job.

The rest of your job—harmonizing the sight and guns, and loading ammunition ready for a mission—is explained in the following pages.



Adjusting the Sight

The Navy MK 9 reflector sight fits into a bracket mounted on top of the sight cradle directly in front of you. To adjust the sight as it may be sometimes necessary in harmonizing it with the guns, make the adjustments on the sight head. For full instructions in making these adjustments, see the section on the MK 9 sight in the general introduction.

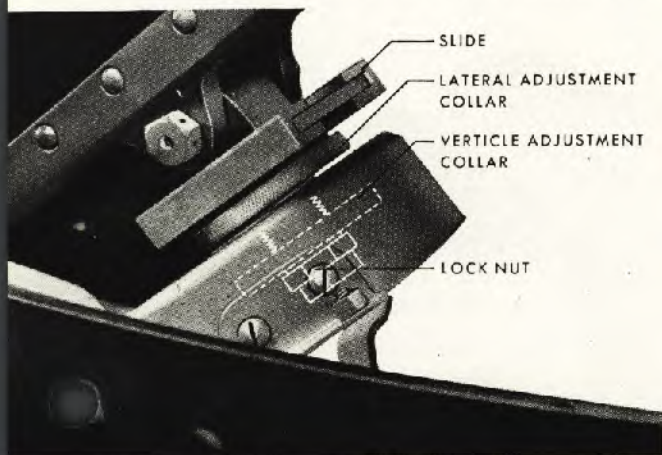
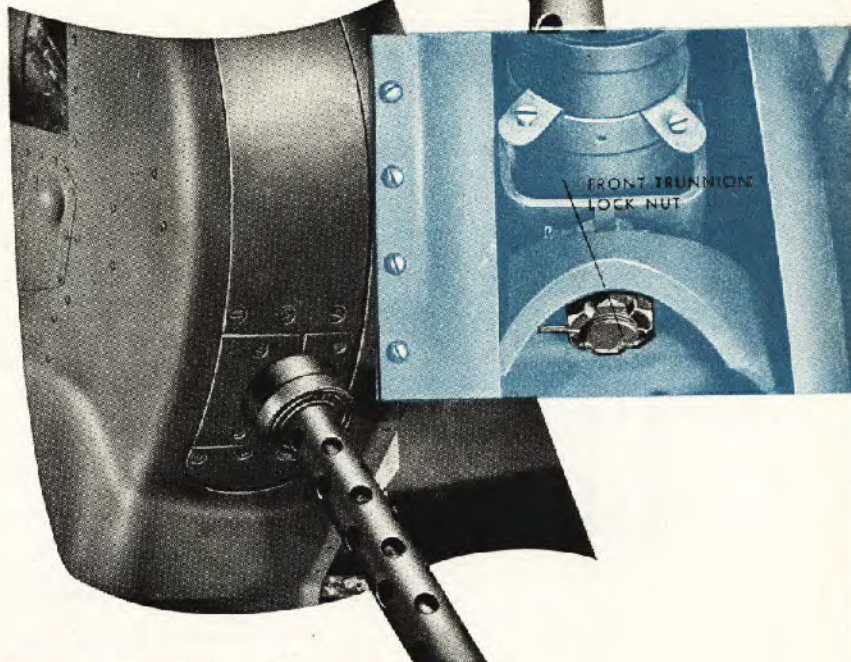
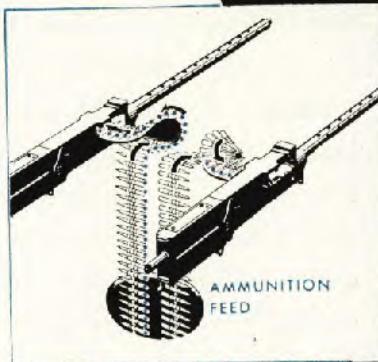
Adjusting the Guns

The guns are mounted in the Consolidated Tail to feed from the inside—the right gun from the left, the left gun from the right. Each gun is held in its cradle by a rear trunnion block and slide and a front trunnion stud bolted into a mounting hole in the cradle. The rear trunnion block, attached to the gun, dovetails into the slide mounted on the cradle; check to make sure the block fits. The front trunnion stud is held by a lock nut and cotter pin.

Special charging units are installed on the inside plates of the guns' receivers, and link ejection chutes on the outside. Make sure that the bolts mounting the charging units are safety wired, and that the cable connections have cotter pins.

Special foot-firing mechanisms are mounted on the outside of the guns and connected to two foot-firing pedals. The pedals operate plungers which trip the sears in the guns. When you assemble the bolts for the guns, make sure the square ends of the sear slides are on the outside of each gun. Mounting bolts on the foot-firing mechanisms must be safety wired. The guns are adjusted up, down, or sideways in their cradles by rear mount adjustment collar and lock nut assemblies.

FOOT-FIRING MECHANISM

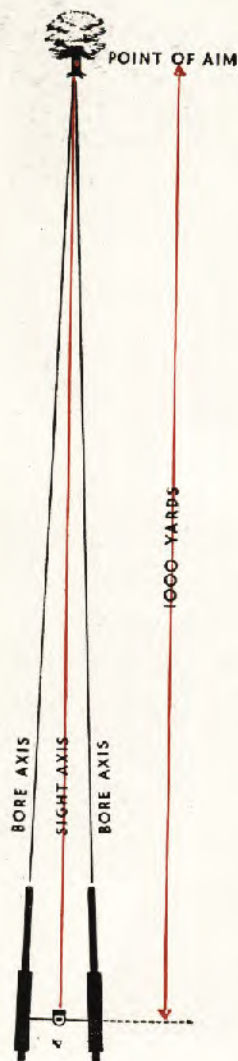


To make the adjustments:

- 1 Loosen the front and rear trunnion lock nuts.
- 2 Turn the top lateral adjustment collar right or left to move the rear of the gun from side to side.
- 3 Turn the bottom vertical adjustment collar right or left to move the rear of the gun up or down.
- 4 Tighten the lock nuts.

By means of these adjustments the guns can be centered in their mounts. Simply turn the collars to the approximate centers of their lateral and vertical adjustment movements. A little practice will enable you to do this quickly and accurately.

Harmonizing the Guns and Sight



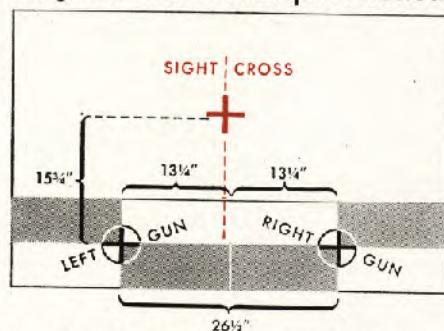
There are a number of ways to harmonize the guns and sight in the Consolidated Tail Turret. The exact procedure will be defined by the Squadron's Gunnery officer. A handy method is to line up the sight and boresight the guns on some small object such as a tree or chimney at least 1,000 yards from your plane.

First remove the two access plates from the rear of the turret. Simply press in to release them. Remove the backplates and bolts from both guns or use a boresighting tool so that you can look through the gun barrels without removing the parts. Then center the guns in their mounts. Now line up the sight using the hand cranks to move the turret until the dot of the sight is squarely on the object. Lock the turret in this position with the mechanism locks.

Then boresight through each gun barrel to line up each gun. Adjust each gun by its rear mount adjustment collars until the spot the sight is centered on is exactly in the center of each gun bore.

Sometimes the amount of adjustment in the rear mount of the guns may not be enough. In that case, boresight each gun on the small object selected, then you must make adjustments on the sight head to line up the dot on the same object.

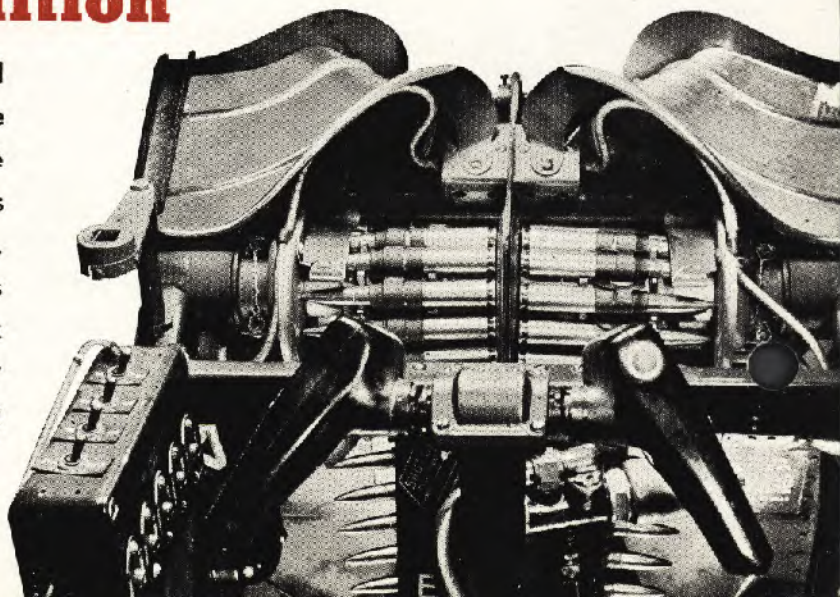
Another method of harmonization is to line up the sight and guns on the special pattern stand such as the one illustrated here.



Set up the stand as level as possible at least 50 yards from the turret. Center the guns in their mounts. Then boresight each gun on the pattern stand and center the sight on the sight cross using the standard technique described in the Sights and Sighting section of this manual. Both methods described here are parallel harmonization.

Loading Ammunition

The ammunition cans, one for each gun, hold about 400 rounds each. They are outside the turret in the fuselage of the plane, and the ammunition belts feed through flexible guides up through the floor of the turret to the guns. To load the guns, first pull the ammunition belts up through the floor of the turret, double-link end up. Drape them forward over the booster motor cylinders and sprocket wheels, making



sure the rounds rest evenly in the sprockets. Then twist the belts slightly and curve them up over the feed chutes to the guns' feedways. Just before the takeoff, press the first links of each belt into its feedway, and the guns are ready to be charged and fired.



Pre-flight Routine

... follow it step by step

1. Install the guns' barrel and oil buffer groups—leaving out the bolts and backplates.
2. Check harmonization of the guns and sight by boresighting on some small object 1,000 or more yards away, or on a pattern stand.
3. While harmonizing the guns, make sure the manual system is working properly.
4. Make sure the gun bolts are assembled properly, to feed from the right in the left gun and from the left in the right gun. Also make sure that the square ends of the sear slides face the outside of the guns. Then install the bolts and backplates in both guns. Replace the gun access plates.
5. Try to rock the guns in their cradles to make sure they are securely mounted. Check to make sure that the front and rear trunnion mounting studs and bolts are safety wired.
6. Check the hand charging units on the inside of the guns and the foot-firing mechanisms on the outside of the guns to make sure they are securely attached and their mounting bolts safety wired. The cable connections to the charging units must have cotter pins.
7. Inspect the hydraulic system and lines. If there are any excessive leaks, report them.
8. Inspect the electric cables. Make sure all cannon plug connections are tight. Report any frayed or damaged cables.
9. Check the oxygen connections.
10. Make sure the plexiglas dome and bullet-proof glass are clean.
11. Check the hydraulic fluid level gage on the reservoir in the actuator unit mounted on the fuselage wall. If the oil is below the FULL line, notify turret maintenance.
12. Turn on the main power switch on the fuselage wall. Listen for the hum of the electric motor in the actuator unit, and watch the pressure switch in the unit to see that it is working properly.
13. Open the turret doors. Look in and make sure the main shutoff valve, azimuth emergency release valve, and elevation bypass valve are closed. Then get in the turret.
14. Turn on the sight switch and rotate the sight rheostat from dim to bright to adjust the brightness of the light and make sure the rheostat is working properly. Flip the sight filament switch to both positions. If either filament is burned out, replace the bulb. Make sure the optic head is clean.
15. Turn on your trigger switch. Check head-space in the guns. Then pull one trigger at a time, charging the guns each time, and check electric triggers for proper adjustment—listen for a "click" as the firing pins of the guns release. Both guns should fire from either trigger.
16. Turn on the booster motor switch. Test the

booster motors by tilting the boosters toward the guns. Make sure the motors cut on and off sharply, without lag.

17. Turn off the trigger switch and test the foot-firing system by opening the foot-firing mechanism lock and stepping on the foot-firing pedals. Listen for a click as the plungers operate the guns' sear slides.
18. Remove the azimuth and elevation mechanism locks from the shafts and place in their clips. Make sure these locks are removed before trying to run the turret.
19. Open the main shutoff valve, turn on the power switch, and run the turret under power in azimuth and elevation, to check on ease of operation. Make sure the turret operates with either safety switch held down. Run the turret as far to the left and right as it will go to make sure the limit stops halt the guns before striking the plane. Stop the turret and check for creep.
20. Put on your oxygen mask, connect it, and test by turning on the direct flow valve. Check the gage to make sure there is proper pressure, in the tanks, as determined by your crew chief. Close valve.
21. Plug in your headphones and microphone to test whether your crew mates can hear you and you can hear them.
22. Plug in and test your heated suit and the rheostat.
23. Make sure your trouble light operates. Pull the light out on its cord to make sure the retractable reel is working properly.
24. Check operation of the warning bell by having the pilot ring it from his position.
25. Close all valves, turn off all switches, and get out of the turret.
26. Inspect the ammunition belts to make sure the rounds are in good condition and properly belted.
27. Load both ammunition cans. Feed the belt through the flexible guides; pull them up through the chutes in the turret, over the booster sprockets, and press the first rounds into the guns' feedways.
28. Make a last visual check of the turret.
29. Move the turret by hand crank into stowing position—guns pointing straight back and raised two-thirds of the way between level and straight up. Replace the azimuth and elevation mechanism locks on their shafts in locked position, get out and close the turret doors—ready for the takeoff.

Post-Flight

Before Landing

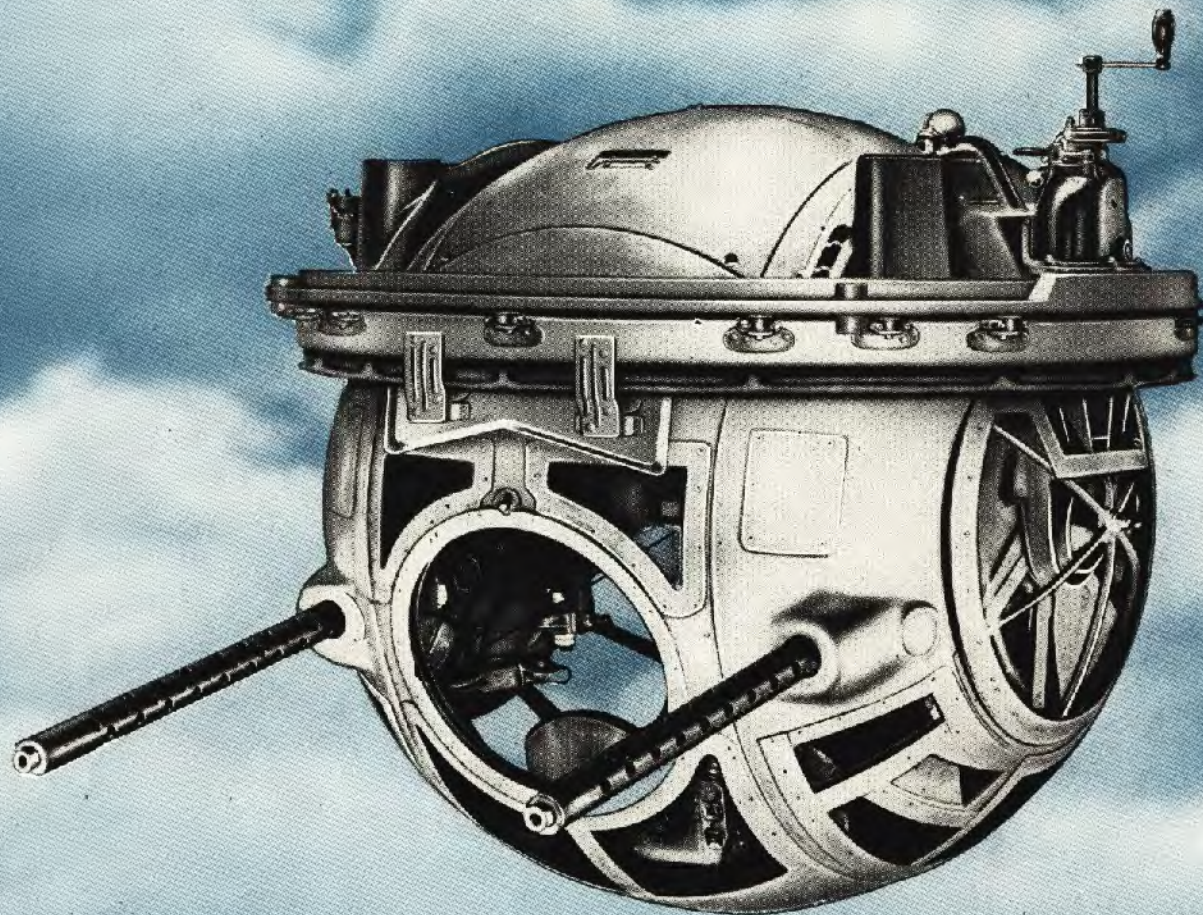
1. Clear guns by opening the gun covers and hand charging the guns twice. Remove ammunition from feedways and upper chutes.
2. Run the turret to stowing position.
3. Close the main shutoff valve and turn off the switches. Replace both mechanism locks.
4. Get out of the turret and fasten the doors.
5. Turn off the main power switch.

After Landing

1. Remove all ammunition from the flexible

guides and ammunition cans.

2. Remove gun access plates and field-strip guns.
3. Clean the gun casing groups, inspecting their condition as outlined in post-flight checks in the Guns section of this manual.
4. Then detail strip the parts removed from the guns, cleaning and inspecting them as outlined in the Guns section.
5. Report any malfunctions of turret or guns noted on the mission.



The Sperry Retractable Ball Turret

SPERRY 250SH-1

The Sperry Lower Retractable Ball mounted in the belly of the PB4Y-1, is the deadly and efficient defender of the bomber's once soft underside. It was built especially for the PB4Y-1 whose ground clearance calls for a ball turret that can be kept out of the way on takeoffs and landings. Its guns sweep in a full circle and offer protection from any fighter who dips below the bomber's level. Its sight, the Sperry K-4, computes deflections automatically even when the gunner, swinging around below the plane, is unable to tell exactly which way he is facing.

FACTS AND FIGURES

The retractable mechanism to pull the turret up into the belly of the bomber is simple. The big hydraulic cylinder is secured to a supporting beam in the top of the plane and the turret is suspended from a piston riding within the cylinder. A hand pump mounted on a fuselage wall supplies hydraulic pressure to force the piston up and raise the turret, which can be locked in place with safety hooks on the upper trunnion housing. A valve on the fuselage releases the hydraulic pressure and permits the piston and turret to slide down.

POWER

The Sperry Lower Ball operates hydraulically on pressure built up by a hydraulic pump driven by constant speed electric motor.

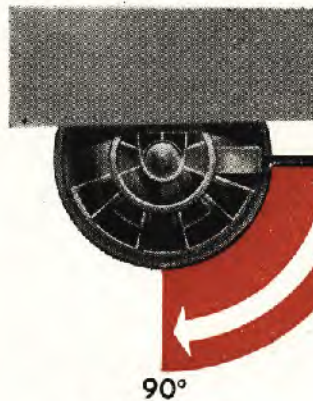
SIGHT

Its sight is the K-4 Sperry automatic computing sight, described in the Sights and Sighting section of this manual.



AZIMUTH

The turret can turn 360 degrees—a full circle—in azimuth.



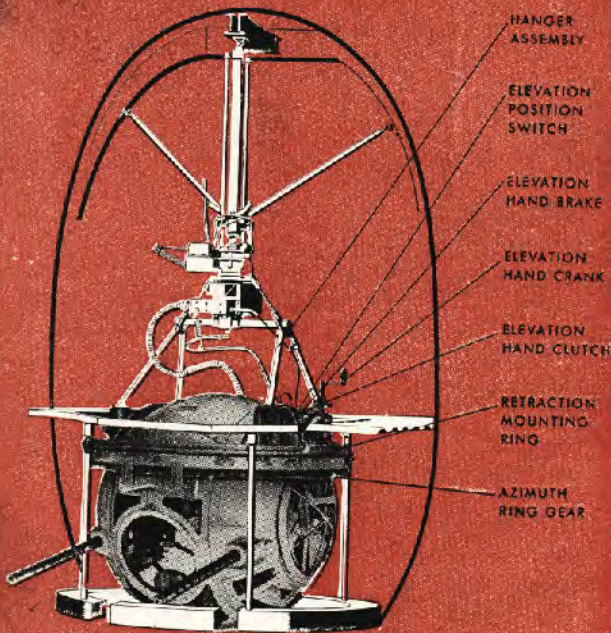
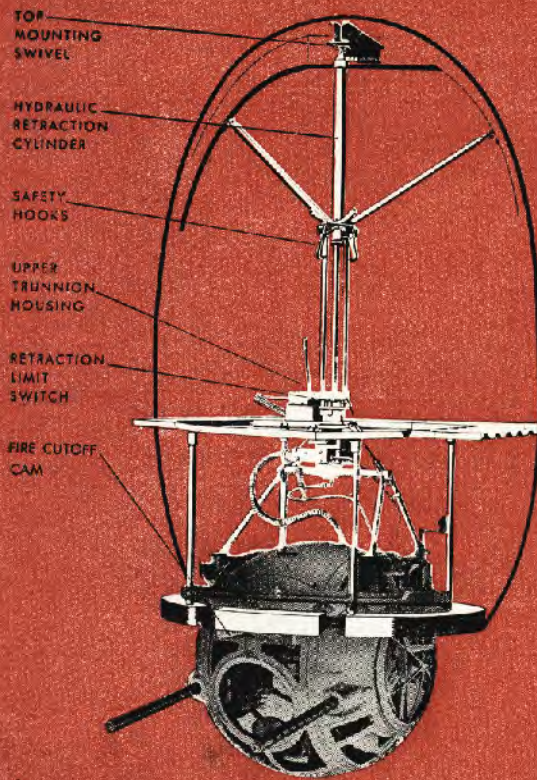
ELEVATION

0° In elevation, the turret guns can be lowered and raised from level (0 degrees) to straight down (-90 degrees).

ARMOR

An armor plate panel forms the bottom of the seat and extends up to the hinge of the door, protecting the gunner's trunk in battle position.

The stowing position for the turret and guns after they have been retracted is 180 degrees azimuth and -22 degrees elevation.



STOWING POSITION

Getting In

To start getting acquainted with the Sperry Ball, get in. You will have to be careful—men have been injured and even killed because they did not know the right way to get in, or were careless about it. The turret ball is heavy and yet delicately balanced; unless it is locked in place, it may swivel and break a man's leg or snap him almost in two as he attempts to enter.

Remember also, as you step into the turret for the first time, that on combat missions you will never get in until your bomber is in full flight, and will always get out before the landing. The ball turret, hanging down beneath the plane, is no place to be when the bomber is moving along the ground. As you get in, take these steps carefully and in proper order. If you go about it right, getting into the turret is as safe as climbing into a rocking chair.

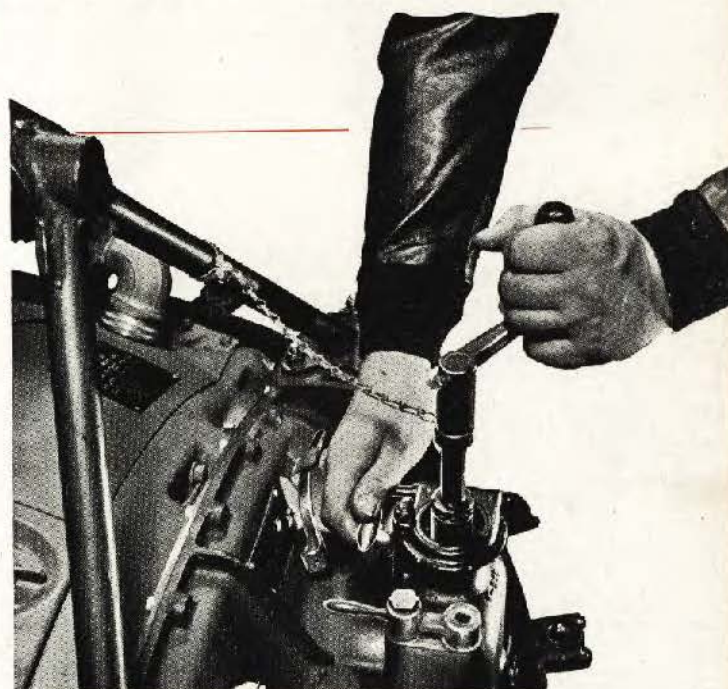
1 Be sure the elevation hand clutch is in the *IN* position. Remove the elevation hand crank from its clip on the outside of the turret. Slip it on the elevation hand control shaft.

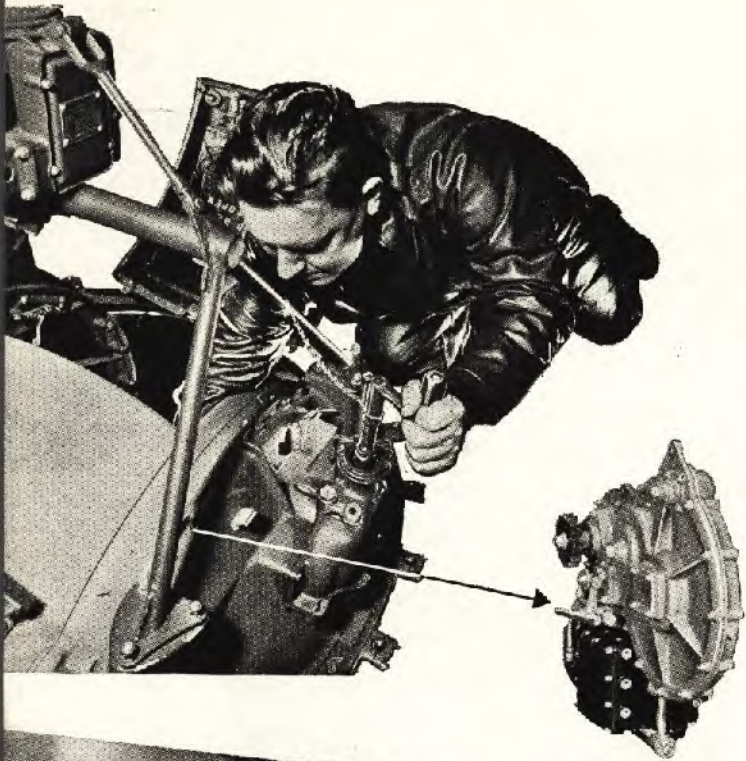
2 Loosen the elevation hand brake—a small lever beside the elevation hand control shaft.

3 Keep your left hand firmly on the hand crank. Take the outside elevation power clutch handle from its clip, put it on the outside elevation power clutch shaft, and move it to the *OUT* position. This disengages the elevation power gearing, allowing free up and down movement of the turret. Unless you keep a tight hold on the hand crank, the weight of the guns will spin the turret down.

4 By turning the elevation hand crank with your left hand, move the turret until the guns are pointing straight down at -90 degrees. This will bring the turret into position so that you can open the entrance door.

5 Keep your grip on the hand crank. Unfasten and lift the door. **Don't let the door fall back.** To prevent springing the hinge, never put excess weight on the door.





6
Still keep your grip on the hand crank. Reach down inside the turret, forward and behind the big elevation gear housing on the left, and move the inside elevation power clutch lever up to engage it. You will have to rock the elevation hand crank back and forth as you push the clutch in place. This re-engages the elevation power gearing, locking the turret firmly in gear.

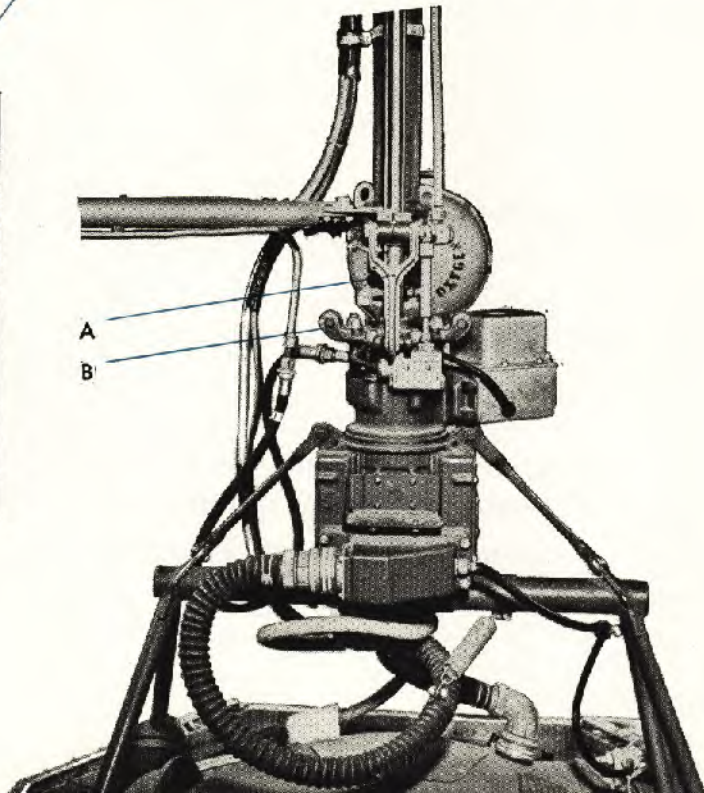
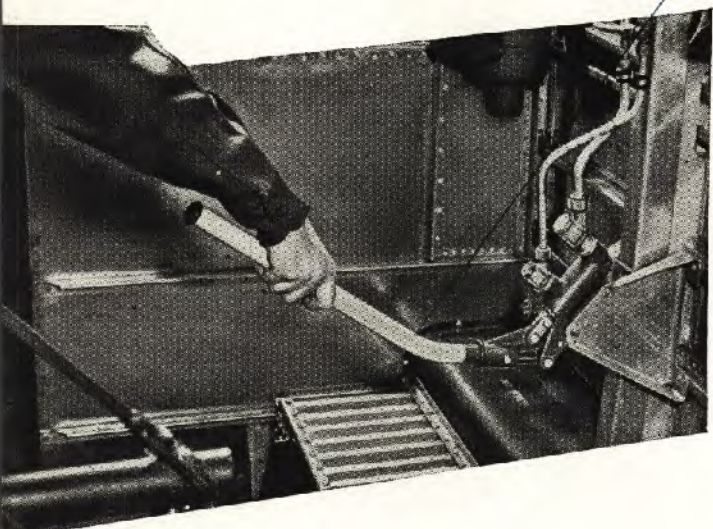
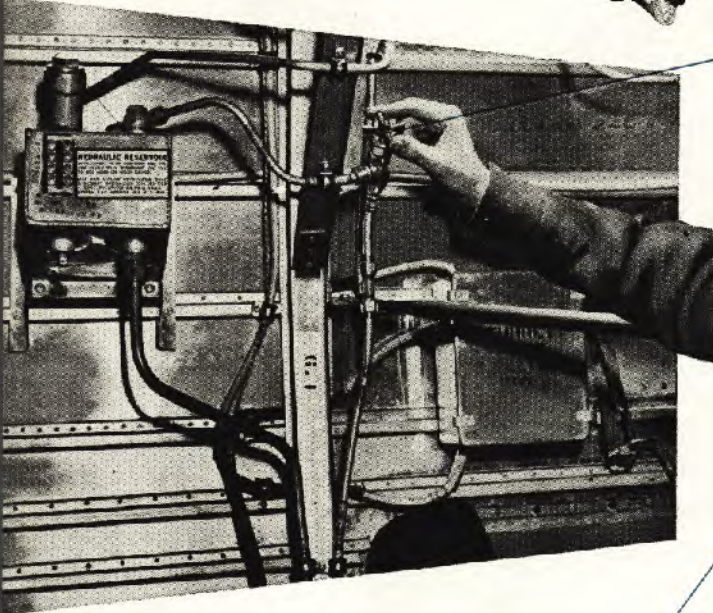
7
Move the outside elevation hand clutch to OUT. Remove the hand crank and outside power clutch handle and replace in their clips.

8
Close the turret entrance door and prepare to lower the turret by closing the hydraulic valve.

9
Work the hand pump to lift the turret just enough to release the safety hooks.

10
Open the safety hooks (A) to disengage them from the upper trunnion housing (B).

11
Open the hydraulic valve slowly, letting the turret ease down. Don't open the valve too fast.



12

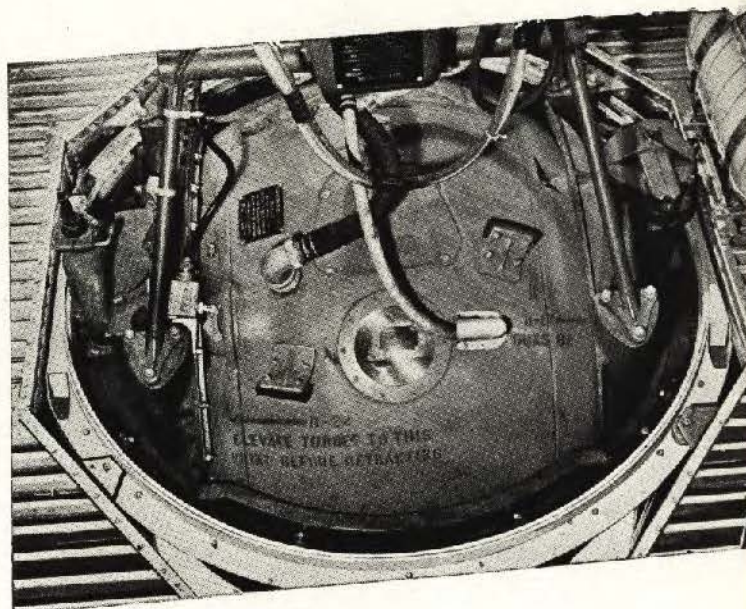
Make sure that the turret is properly seated at its lowest position. Tapered bushings, mounted on the azimuth ring of the turret, should sit squarely in holes provided for them in the plane's floor ring. If they don't, jockey the turret until they do.

13

Make sure the master switch on the support beam is o.

14

Open the turret entrance door. Test the turret by grasping the supporting structure and putting your right foot on the seat. Try to work the turret with the pressure of your foot. There should be no movement. If there is movement, the elevation gearing is not engaged.

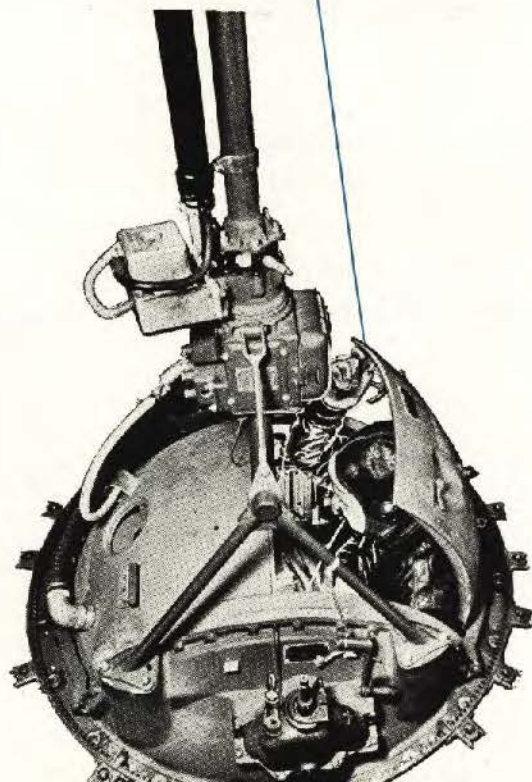


15

Lower yourself into the turret by grasping and swinging down on the support frame. Put your right heel on the right foot rest, then your left heel in the range pedal—being careful not to throw your whole weight on the range pedal.

16

Fasten the safety belt. Close and fasten the entrance door. Make sure that the door latches are securely closed. Then you are ready to go.

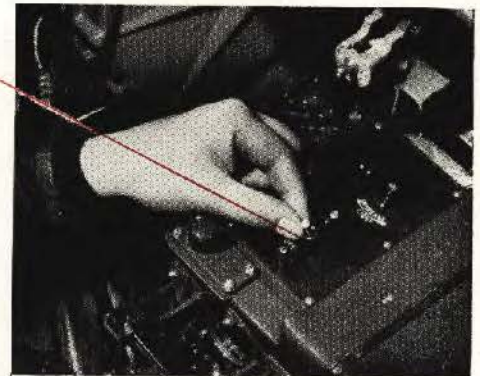
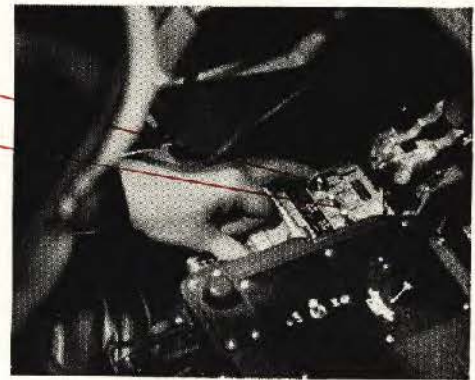


Operating the Turret ... Where to Find the Controls

... How to Use Them

- 1 Make sure the **azimuth power clutch** is engaged—the lever at the upper right should be down.
 - 2 Flip on the **main power switch**—a toggle switch under a wire guard on the junction box beside your left knee.
 - 3 Right beside the power switch are two **gun selector switches** for firing the guns separately or together. Flip both of them on.
 - 4 Turn on the **sight switch** directly in front of your nose on the sight. Turn the sight rheostat beside it to adjust the brightness of the light. **Never operate the turret under power with the sight switch off.**
 - 5 Finally, grasp the two handgrips. Don't worry about safety switches—the turret has none. But, notice that in azimuth the controls work exactly opposite to all other turrets. To move the turret **right**, swing the handgrips to the left; to turn **left**, swing them to the right. Pull back on them to tilt the turret and guns up, and press forward to turn the turret and guns down. Don't jerk. Steady, smooth tracking is especially important in using the Sperry sight.
- The other controls you will use in combat are right at hand. On the top of each handgrip, under your thumbs, are **firing buttons**, used instead of triggers on the Sperry Ball.
- The fuses which protect the Sperry's electrical circuits are in the junction box beside your left knee, where you found the main power switch.
- For charging the guns, you will find two handles next to your feet. Reach down to the floor, arms crossed, and pull the handles up carefully until the slack is out of the cables. Then pull them up sharply all the way. Don't ride the cables on the return action; allow them to go back under their own power, still keeping your hands on the handles.

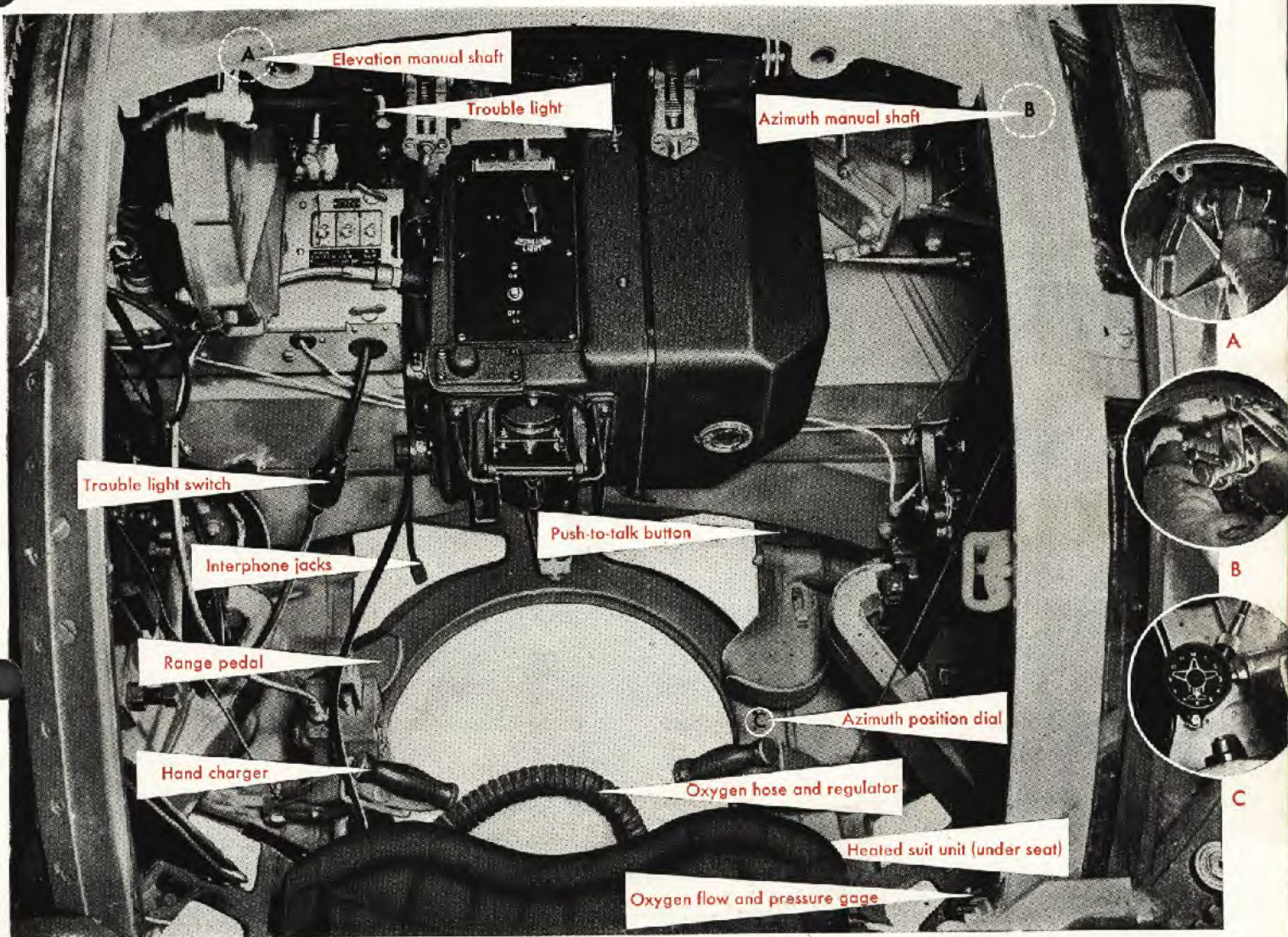
Once you are seated, the controls and switches of the turret are spread before you. Check clutches and turn on the switches in exactly the order shown here.



Left hand pulls to left

Right hand pulls to right

Using the Auxiliary Units



You will find a demand type regulator with a hose connection for your oxygen mask right under your seat. Alongside your right ear is the flow and pressure gage. The oxygen is drawn from the plane's central tanks in most models. The heated suit plug-in is also under your seat. The interphone jacks for your headphone and throat microphone lead out of the junction box. A trouble light is clamped in a clip just under top rim of the ball to the left of your head. By your right foot is a new azimuth turret position dial, in which a cut-out of your guns rotates

upon a clock face and shows you your azimuth position at all times. For manual operation of the turret in emergencies, shafts designed for use with removable hand cranks are on the right and left side of the turret—right for azimuth, left for elevation. The hand cranks are stored in clips above your head.

To change to manual operation:

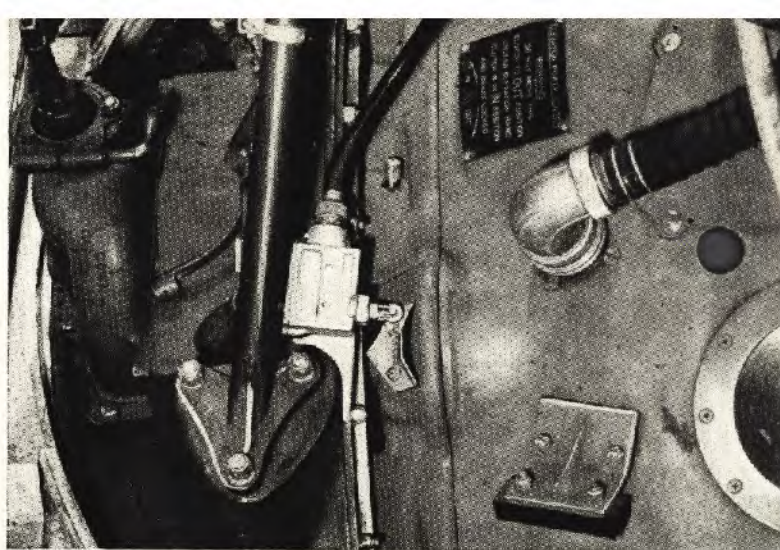
- 1 Turn off the main power switch.
- 2 Remove the hand cranks from their clips and place them on the shafts.
- 3 Disengage azimuth and elevation clutches.

Getting Out

1. To get out of the turret, drive it to -90 degrees in elevation, so that the guns point straight down; this will bring the doorway into place in the floor of the bomber. At the same time, drive the turret to 180 degrees in azimuth—six o'clock on your azimuth turret position dial.

Turn off all switches. Open the door and step out. Close the entrance door.

- 2.** Close the hydraulic valve.
- 3.** Using the hand pump raise the turret until the safety hooks can be closed.
- 4.** Close the hooks. They must catch the flange on the upper trunnion housing to hold the turret securely.
- 5.** Use the elevation hand crank to crank the guns to -22 degrees elevation. (The turret will already be at 180 degrees azimuth.) You will know that the guns are at -22 degrees when the elevation switch cam, a raised metal plate

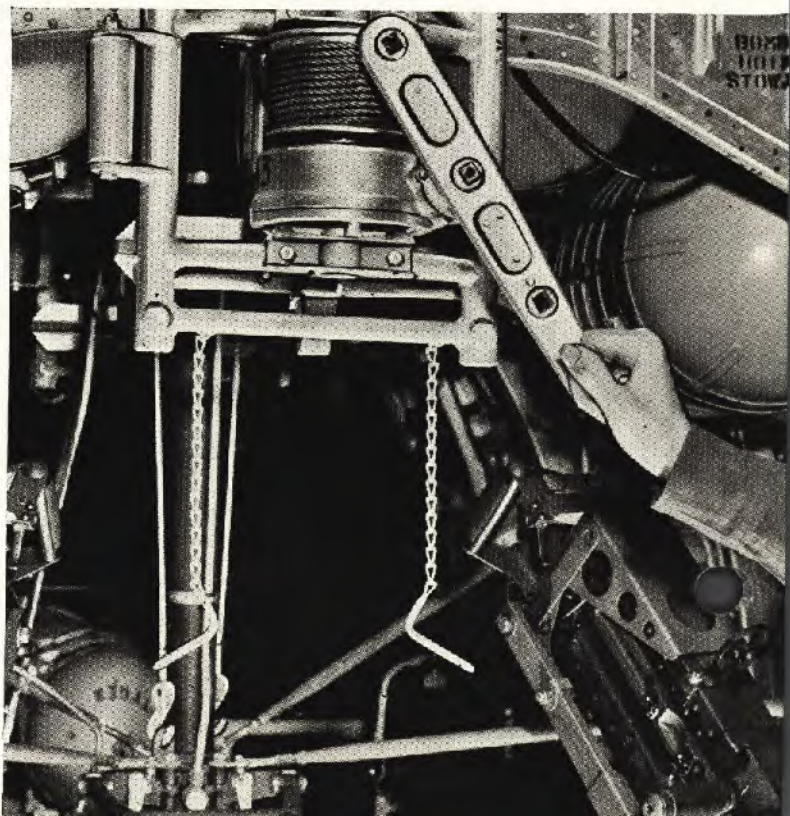


fastened to the upper curve on the ball, moves up as you turn the ball in elevation, and presses against the elevation retraction position switch, throwing it on. This switch flashes a light in the pilot's compartment to tell him when the ball turret is retracted and the plane is ready to land.

- 6.** Engage the outside elevation power clutch, using the handle in the clip on the trunnion ring support. Replace the handle in the clip.
- 7.** Tighten the elevation hand brake and replace the hand crank in its clip. Always make sure the clutch handle and crank are in their clips.

Emergency Retraction

Don't worry about the possibility that the hydraulic retraction gear might get out of order in flight—if it does, you can still raise the turret by means of the plane's bomb hoists. These hoists are two winch, cable, and pulley units mounted on the top structure of the plane on either side of the turret position. Use them only in an emergency when the retracting mechanism won't work.



1

Run the guns to 180 degrees azimuth and -90 degrees elevation and get out of the turret.

2

Unwind the winch cables and feed them over their opposite pulleys—the rear winch cable over the front pulley, the front cable over the rear pulley. Hook the ends of the cables into the top of the turret hanger assembly.

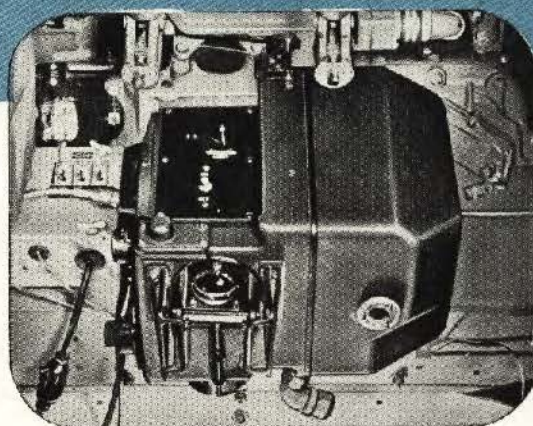
3

With the assistance of one of your crew mates, crank both winches at the same time, evenly and slowly, until the turret is raised enough for the retraction safety hooks to catch and support the turret. Close the safety hooks. Then crank the guns up into their stowing position—about -22 degrees elevation—just as you do after normal retraction of the ball.

Preparing the Turret for Combat

With the working information contained in the preceding pages—and sufficient practice tracking with the Sperry sight—you could easily take over the Sperry Ball in combat. If you specialize in this turret, however, that will be only part of your job.

The rest of your job—adjusting sight and guns and loading ammunition for a mission—is explained in the following pages.



The Sight

The K-4 is an upsidedown type of automatic computing sight built especially for the Sperry Ball. Held by a single long mounting pin, it hangs down from the sight cradle on a level with your head. Connected to the sight are three flexible shafts which bring it the turret movement and range data needed for computing deflections. The upper shaft entering the top rear of the sight revolves as the turret moves in azimuth. The lower shaft at the top rear revolves as the turret moves in elevation. The third shaft, on the left side, leads to the range pedal, which you move with your left foot to frame the target in the sight reticles.

Adjusting the Guns

The guns are mounted in the Sperry Ball to feed from the outside—the right gun feeds from the right and the left gun from the left.

The guns are held in their cradles by a rear trunnion block and slide (A) and two front trunnion studs (B). The rear trunnion block, attached to the rear mounting holes of the gun, dovetails into the rear trunnion slide—merely check it to make sure that it rides snugly in the slide. The front trunnion studs, which screw into the front mounting yoke of the cradle and into threaded holes in both sides of the

gun adapters, must be safely wired.

Special charging units (C) are installed on the inside plates of the guns, with mounting bolts which must be safety wired. The cable connection to each unit must have a cotter pin (D). Special link ejection chutes (E) are installed on the inside of the guns, where they are held by the guns' belt feed pawl pins and cotter pins.

The guns can be adjusted up, down, or sideways in their cradles by using an adjustment screw and bolt assembly provided on each rear trunnion.

To make the adjustments:

1

Loosen the vertical lock nuts and adjustment nuts.

2

Loosen the lateral lock nuts.

3

Turn the lateral adjustment screws on each side of the mount right or left to move the back of the gun from side to side.

4

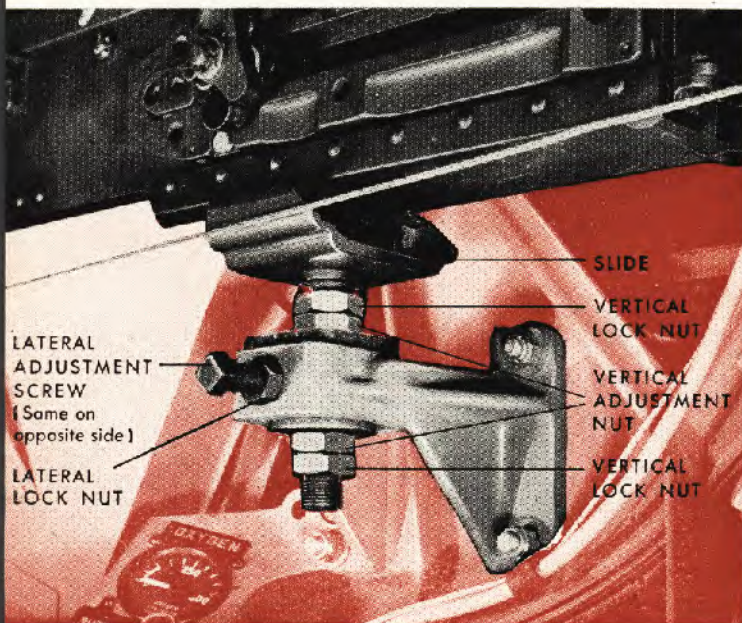
Turn the vertical adjustment nuts right or left to raise or lower the back of the gun.

5

When the gun is in its proper position, tighten all lock nuts.

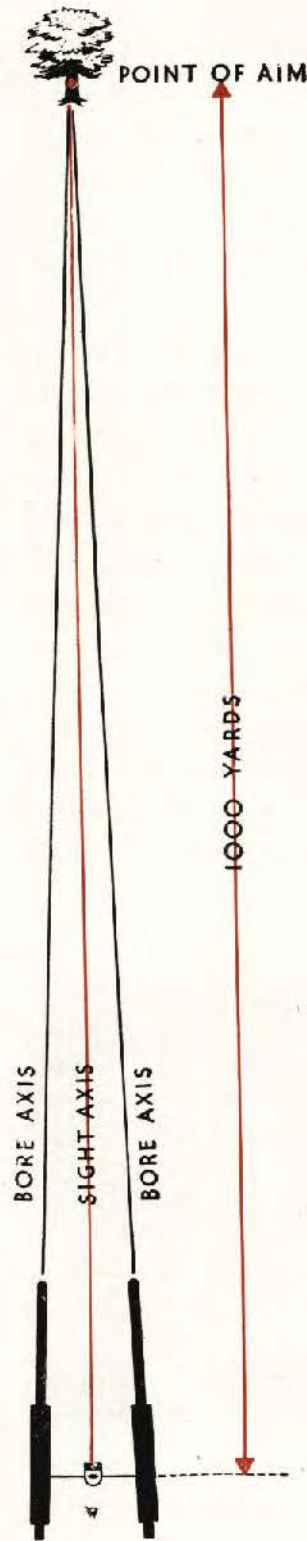
By means of these adjustments the guns can be centered in their mounts.

To center them you will have to move the adjustment screws and nuts back and forth until you find the approximate center of both the lateral and vertical adjustment movements. With practice, you will be able to center a gun quickly and with little error.



Harmonizing the Guns and Sight

There are a number of ways to harmonize the Sperry Ball's guns and sight. Because of the Ball's computing sight and compact construction, they are more complicated than the procedures for other turrets. In all cases the sight must be removed and re-installed in the turret to do a good job. The handiest method for gunners is to boresight the guns and line up the sight on some small object, such as a tree or a chimney, at least 1,000 yards from your plane. This is known as the field, or distant object, method of harmonization.



First move the guns to zero elevation. Get out of the plane, remove both gun access plates from the ball, and the backplates and bolts from both guns. (Or you can use a boresight reflector to enable you to sight through the barrels without removing the parts.) Open the turret door.

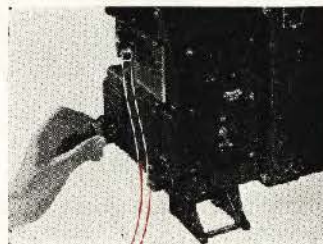


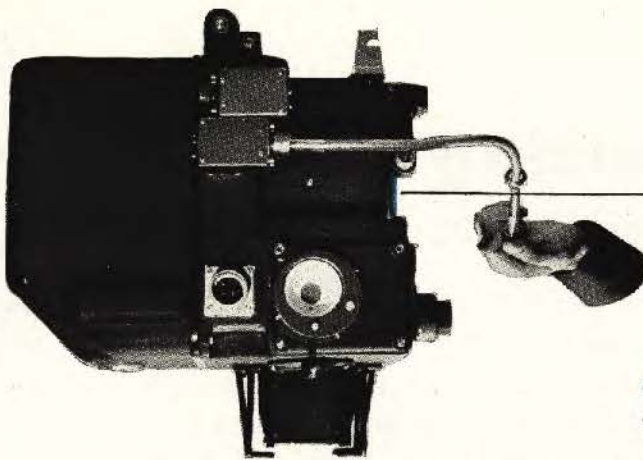
Then center one gun in its mount, as directed on the preceding page—and you are ready.

1 Disengage the azimuth and elevation power clutches. Line up the centered gun on the object selected, using the handcranks to move the turret until the object is exactly in the center of the gun bore. Then lock the turret in this position by re-engaging the azimuth and elevation power clutches.

2 Line up the other gun on the same object by turning its vertical and lateral adjustment screws and nuts. Don't move the turret as you do this. When you have the object exactly in the center of the gun bore, tighten all lock nuts.

3 Disconnect the electric cable and all flexible shafts at the sight—except the azimuth rate shaft, which can be disconnected more easily from the turret gearing, leaving it attached at the sight. Remove the lamp and slip out the deflection dial cover. Then set the target dimension dial on the sight at 20 feet and the range dial at 1,000 yards, using a flexible shaft to rotate the range dial.





4

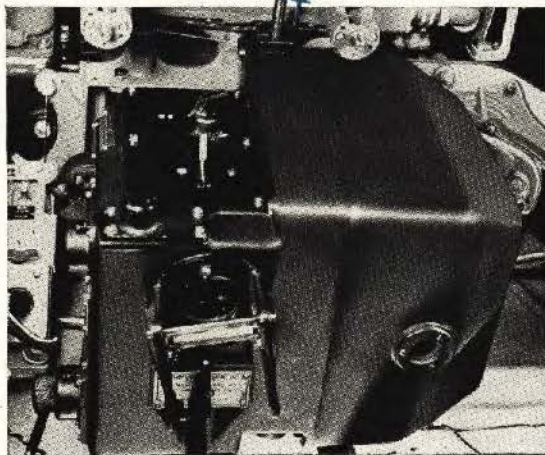
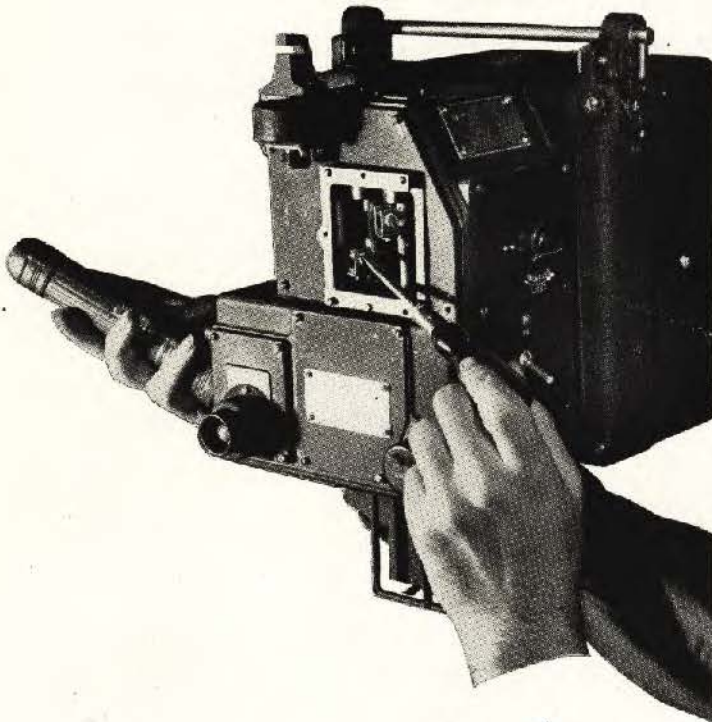
Then set both deflection dials to zero, using a piece of flexible shaft, or the range shaft, in the elevation input, and the azimuth shaft already in the azimuth input, to rotate the dials.

5

Sighting through the optic head, use a screwdriver to turn the thumbscrews on the azimuth and elevation deflection dial shafts until the reticles are exactly centered on the same object the guns are boresighted on. If daylight shining through the lamp aperture is not sufficient to light up the optic head and reticles, use a flashlight or your trouble light.

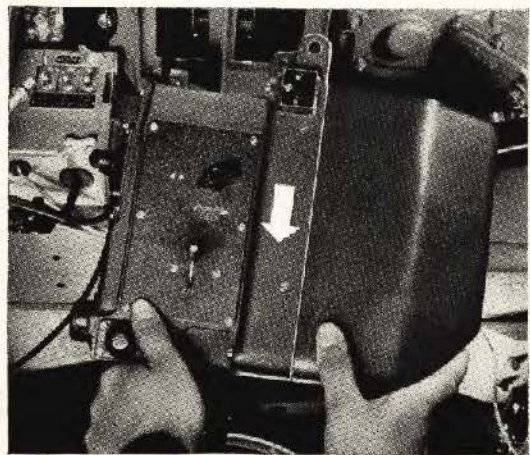
6

Check the deflection dials to make sure they have not been moved off zero in this operation. If they have, return them to zero and then center the reticles on the object again. Replace the deflection dial cover.



7

Move the turret by handcrank to zero azimuth and zero elevation and lock by reengaging the azimuth and elevation power clutches.



8

Remove the sight from its mounting bracket by unlocking and withdrawing the long mounting pin. Handle the sight carefully.

9

Set the azimuth and elevation position dials to zero, using the azimuth shaft to rotate the azimuth dial and a piece of flexible shaft to turn the elevation dial.

10

Connect the electric cable and install the sight in the turret.

11

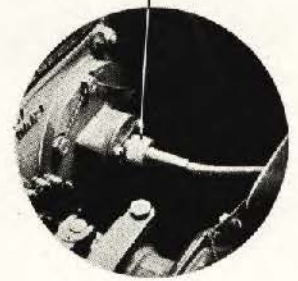
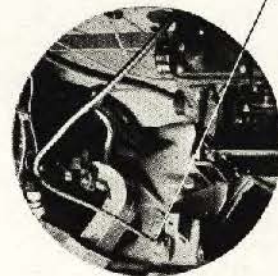
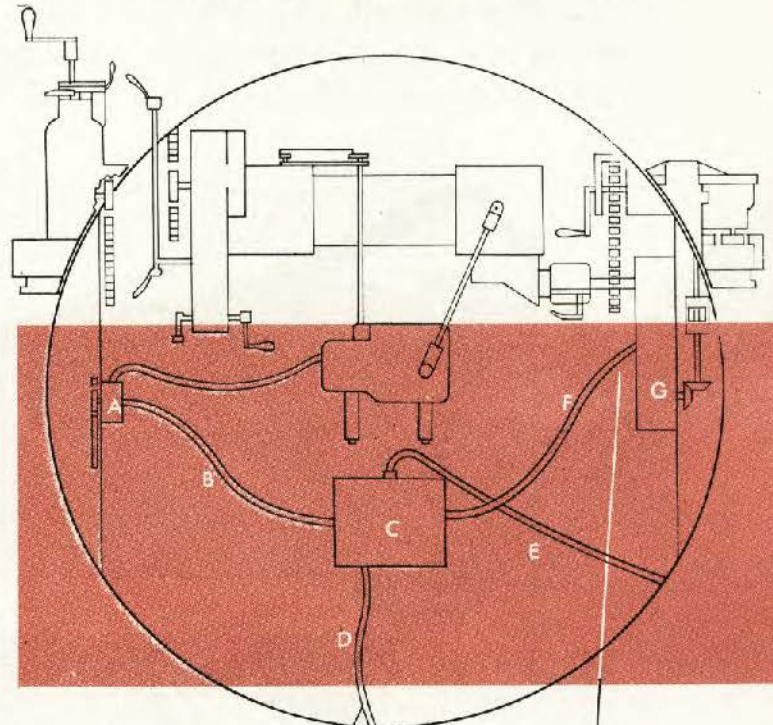
Connect the elevation shaft to the elevation input on the sight—and the azimuth shaft, which was left connected to the sight, to the turret. Make sure you do not move the azimuth and elevation dials off zero in doing this, and make certain all connections are secure.

12

Connect the range shaft to the sight's range input and disconnect it from the range pedal. Rotating the shaft with your fingers, turn the range dial as far past zero as it will go, then back it off a quarter turn of the flexible shaft. With the range pedal all the way up, connect the range shaft to the range pedal again.

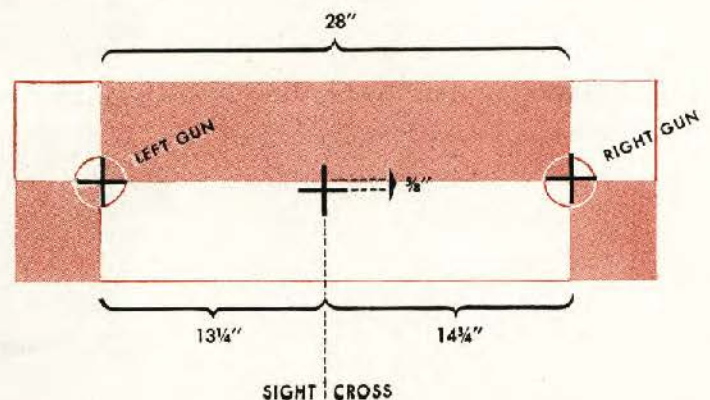
Flexible Shaft Connections

- | | |
|------------------------------|----------------------------|
| A Elevation gear unit | E Electric cable |
| B Elevation rate input shaft | F Azimuth rate input shaft |
| C Sight | G Azimuth gear unit |
| D Range shaft to range pedal | |



Another method

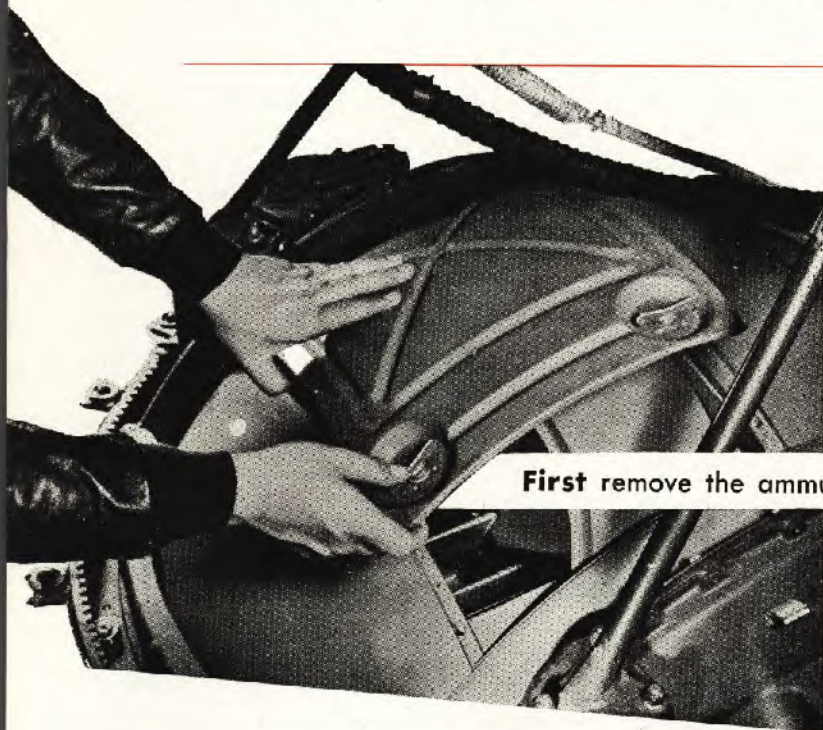
Another method of harmonizing the Sperry Ball is to line up the guns and sight on a special pattern stand, such as the one illustrated here. Set up the stand as level as possible at least 50 yards from the plane. Then boresight each gun on the pattern and line up the sight on the sight cross, using the same procedure as outlined above.



Loading Ammunition

Two ammunition cans, which are a permanent part of the turret ball, one for each gun, hold approximately 500 rounds of belted ammunition apiece.

In some late modifications of the turret the ammunition cans are placed outside the turret, mounted to the hanger assembly, to give the gunner more room; flexible chutes carry the ammunition belts from the cans to the turret and guns. But most Sperry Ball turrets still have cans installed right in front of the gunner. They cannot be removed from the turret and must be loaded from the outside.



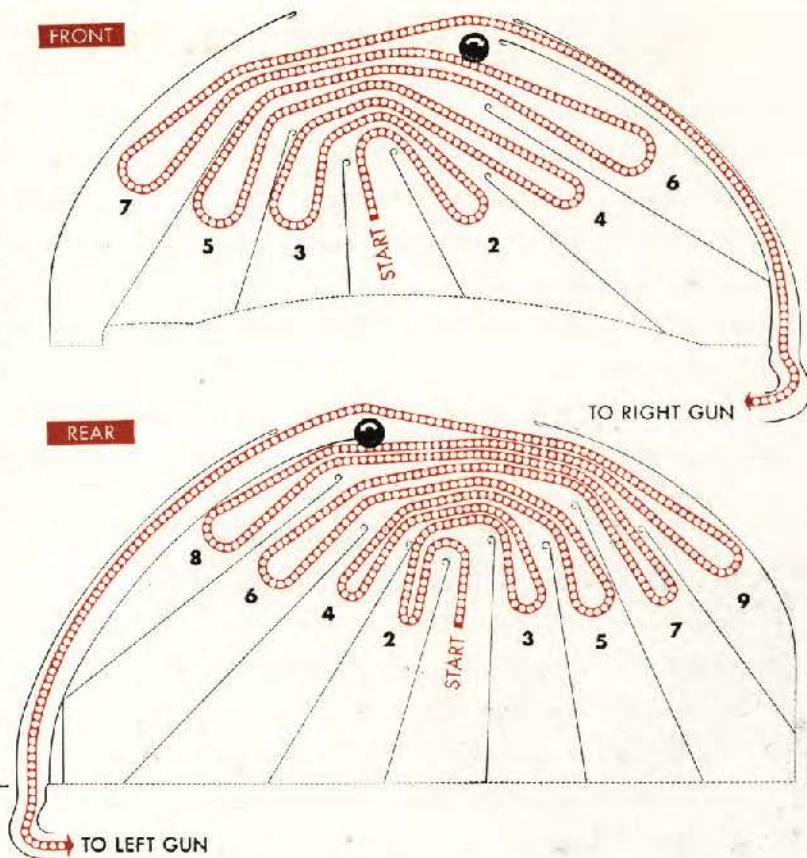
First remove the ammunition can cover—a plate in the turret surface held by four Dzus fasteners, or by two cover latch screws in later models.

Note that the cans are equipped with baffle plates to insure positive feeding and to keep the ammunition from tumbling about.



Start with the single-link end of the belt first, so that the double-link end will feed up into the gun, and fold the belts into the cans in the pattern shown in the diagram. Force the belts down through the chutes to the guns. By putting pressure on the ammunition in the chute, the first round will move into the feedway, over the belt holding pawl.

Caution: Fasten the ammunition can cover securely after loading.



Preflight Routine . . . follow it step by step

(The plane should be over a testing pit to allow normal movement of guns.)

1. Install the guns' barrel and oil buffer groups —leaving out bolts and backplates.
2. Check harmonization of sight and guns by boresighting on an object at least 1,000 yards from the plane, or a pattern stand.
3. While harmonizing the guns, make sure the manual system is working properly.
4. Make sure the gun bolts are assembled properly, to feed from the right in the right gun and from the left in the left gun. Then install bolts and backplates in both guns.
5. Try to rock the guns in their cradles to make sure their mounts are secure. Check to make sure the rear trunnion blocks fit securely in the rear trunnion slides, and that the front trunnion studs are safety wired.
6. Make sure the bolts mounting the charging units to the inside of the guns are safety wired and cable connections have cotter pins.
7. Inspect the electric cables. Make sure all cannon plug connections are tight. Report any frayed or damaged cables.
8. Make a visual check of the fuses in the junction box, using your trouble light. If any are burned out, have them replaced. (The spare fuses carried in the spare parts box should be saved for combat emergency.)
9. At the same time, check your trouble light. Turn on the switch and make sure the bulb is bright.
10. Check oxygen and interphone connections in the turret.

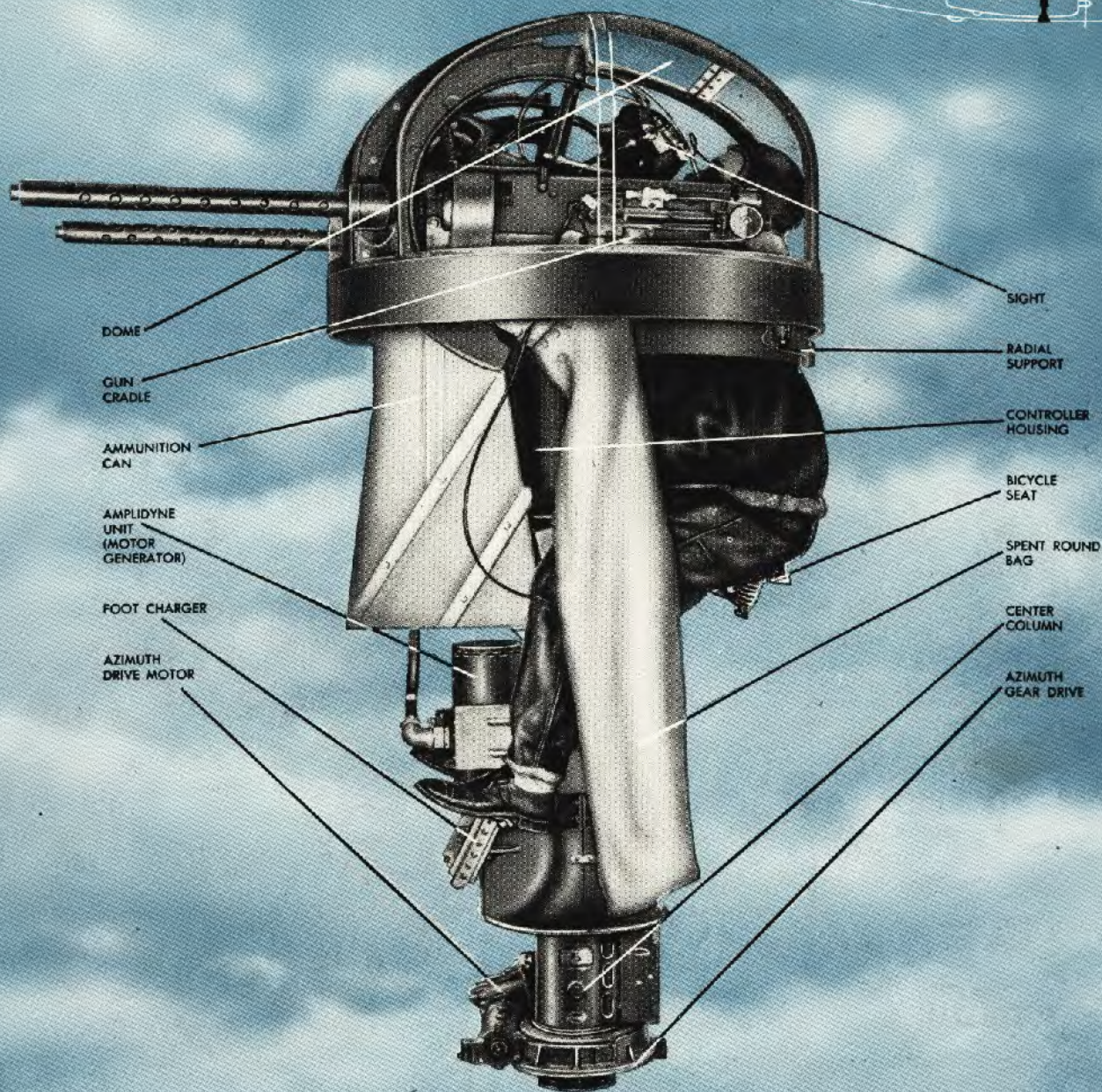
11. Inspect all hydraulic lines. If you find excessive leakage, report it immediately.
12. Check the round gage on the side of the oil breather tank. If oil is not level with the bottom of the gage window, report it.
13. Make sure the plexiglas and safety windows are clean.
14. Enter the turret correctly — **with care**.
15. Make sure that the inside azimuth and elevation power clutches are engaged.
16. Turn on the main power switch.
17. Flip on the sight switch. The sight motor should start, the sight bulb light up. Turn the sight rheostat to check operation. Make sure the optic head is clean.
18. Check all input shaft connections to the sight. Make sure they are tight.
19. Work the range pedal with your foot to make sure the reticle moves in response.
20. Make sure both gun chambers are empty. Then turn on both gun selector switches. Check the guns' headspace. Pull one trigger at a time, charging the guns each time, and check the Electric Triggers for proper adjustment—listen for a "click" as the firing pins of the guns release.
21. Turn off right gun selector switch, and make sure either trigger operates the left gun's Electric Trigger. Then turn on right gun selector switch and turn off left gun selector switch. Make sure that each trigger sets off the right gun's Electric Trigger.
22. Run the turret under power in azimuth and elevation, to check on ease of operation. Run the guns up to the fuselage to make sure the limit stops are working. Then stop the turret and check for creep.
23. Check the fire cutoff system by swinging the guns on the propeller and antenna loop areas of the plane and attempting to fire. Make sure the guns cease firing with the proper amount of safety margin—your crew chief will tell you how much.
24. Put on your oxygen mask, connect it, and test by turning on the direct flow valve. Check gage for proper pressure, as determined by your crew chief. *Close valve.*
25. Plug in your headphones and microphone to test whether your crew mates can hear you and you can hear them.
26. Plug in and test your heated suit and operation of the rheostat.
27. Get out of the turret and inspect ammunition belts to make sure the rounds are in good condition and properly belted.
28. Load both ammunition cans and feed the double-link end of the belts down through the chutes into the feedways of the guns.
29. Make a last visual check of the turret.
30. From outside, move the turret to stowing position so that it is ready for the takeoff.

Before Landing

1. Clear the guns by opening the gun covers and then hand charging the guns twice.
2. Run the turret to 180 degrees azimuth and —90 degrees elevation. Turn off all switches. Then get out and retract the turret up to stowing position for landing.

Post-Flight

1. Remove the ammunition can cover and clear all ammunition from cans and chutes.
2. Field strip the guns.
3. Clean the gun casing groups, inspecting their parts as outlined under the post-flight check in the Guns section of this manual.
4. Then detail strip the parts removed from the guns, cleaning and inspecting them as outlined in the Guns section.
5. Report any malfunctions of turret or guns noted on the mission.



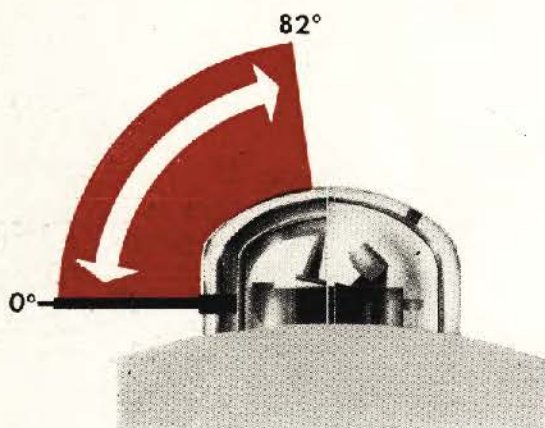
THE BENDIX UPPER DECK

BENDIX 250CE-3 & 4

The Bendix Upper Deck Turret is an all electric turret used exclusively in the PBJ Mitchell bomber where it protects the upper area of the plane.

There are two basic models: the Bendix 250CE-3 and the Bendix 250CE-4. The Bendix 250CE-3, used only on early models of the PBJ, is mounted just back of midship. When waist guns were introduced to the PBJ, the Bendix 250CE-4 was designed for mounting just aft of the pilot's compartment. The two models are essentially alike. The description of the Bendix 250CE-4 in the following pages will also enable you to operate the Bendix 250CE-3.

Facts and Figures



ELEVATION

In elevation, the turret can be lowered and raised from horizontal (0 degrees) to almost straight up (82 degrees).

SPEED

The turret has two speeds—normal tracking speed and high speed.

ARMOR

Armor plate on the turret housing protects the gunner in front, no matter where he aims his guns.



POWER

The Bendix Upper operates electrically on power supplied by the bomber's central system.

SIGHT

Its sight is the N-6A or N-8 optical, fully described in the Sights and Sighting section of this manual.



AZIMUTH

The turret can move 360 degrees—a full circle—in azimuth.

STOWING POSITION

The stowing position is 0 degrees elevation and 180 degrees azimuth—guns level and pointing straight back toward the tail.

Getting In

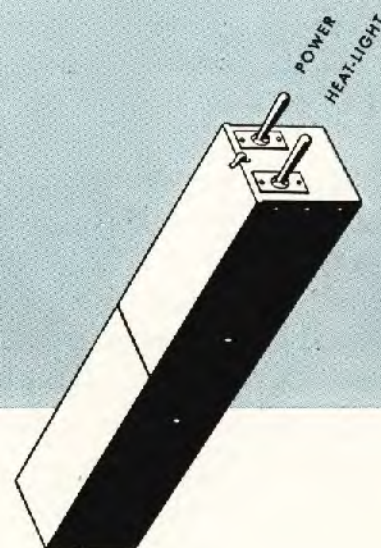
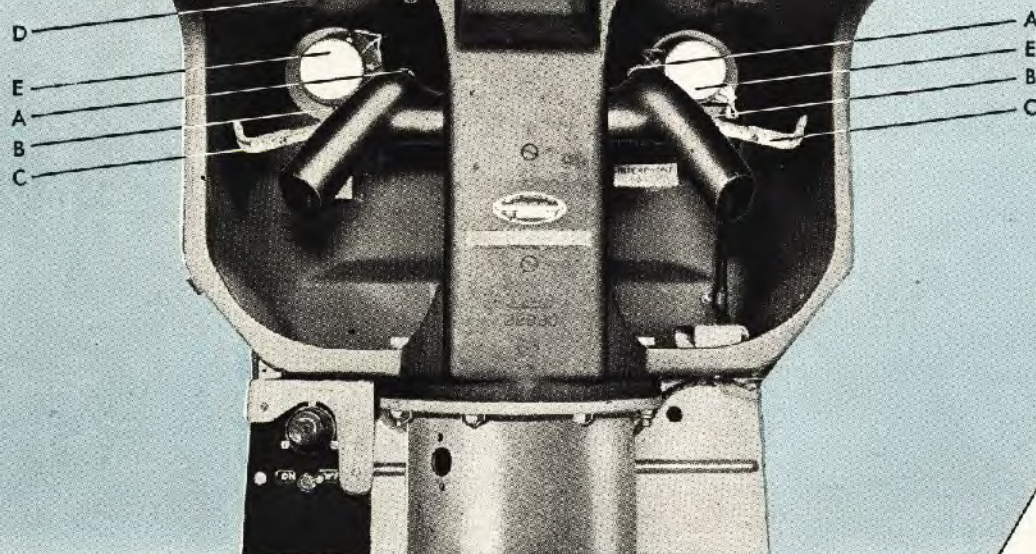
To start getting acquainted with the Bendix Upper, step right in. You won't have any trouble —this is one of the easiest of all turrets to enter and operate.

Adjust the footrests to fit your own height by moving them up or down in the notches on the foot slide.

If you prefer—and a few trials will show you if this is the easiest method for you—you can snap the seat up to its locked position before you get in. Then stoop into the turret, throw one leg over the seat as if you were mounting a high bicycle, and pull yourself up by the inner turret supports.

Or you can leave the seat down, step up on the footrests, pull yourself up by grasping the inner turret supports, brace one elbow over one of the supports, and with your free hand pull up the seat to its locked position beneath you. When you are seated, your eye should be level with the sight. If not, adjust the height of the seat by turning the small handle and swivel on the right side of the seat support, loosening the band that holds the seat to the central column. Slide the seat up or down on the column until you have it just where you want it. Then reverse the handle, tightening the seat in place, and you are **ready to go.**





Operating the Turret

... where to find the controls
... how to use them

You can get the turret into action about as quickly as you could start an automobile on a warm summer day. First reach outside the turret to the left wall of the fuselage; there you will find a long, narrow box with two switches mounted on it. One is the **main power switch**; turn this one on first. Then flip on the **heat-light switch** right beside it, which shoots power to the sight bulb, trouble light, and heated suit unit.

Use the **sight rheostat** (D), on the controller housing just above the left handle, to adjust the brightness of your sight bulb to outdoor lighting conditions.

Then grasp the control handles so that the bottom edges of your hands press down the two **safety switches** (C). As long as either one of these switches is held down, the turret is ready to operate. With the switches up, the turret won't move.

Turn the handles just as you would steer a bicycle—to the right to go right, left to go left. Press down on the heels of the handles to raise the guns. Pull up on them to lower the guns. Move the controls smoothly and deliberately, and you will be able to track any target closely and with deadly aim.

The other controls you will need in combat are practically at your fingertips.

Right under your index fingers on both control handles are the **triggers** (B).

On top of each handle, by your thumbs, are the **high speed buttons** (A) that give you extra speed for changing quickly from one target to another.

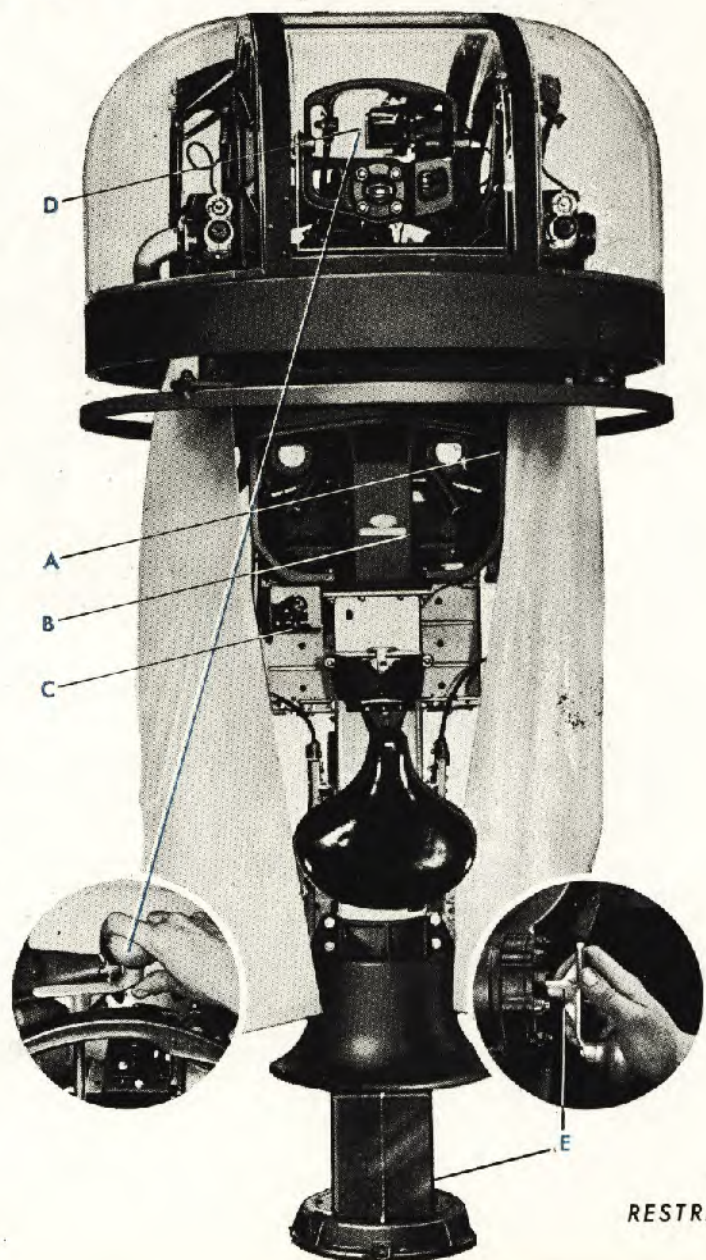
In front of your hands at the back of the controller housing are two shiny metal disks that are your **push-to-talk buttons** (E). Pressure on either disk opens the interphone system for you to speak.

The **charging units** are your footrests. To charge the guns, draw the footrests up as far as they will go in their slides with the toe of your shoe, then step down on them sharply.

Using the Auxiliary Units

Because the Bendix is used only in the PBJ, a low-level bomber, it has no oxygen system. But it has all the other standard auxiliary units. The heated suit plug-in (A) is mounted on the right side of the controller housing. The interphone jacks (B), for connecting your earphones and throat microphone, lead right out of the controller housing. The interphone selector switch is mounted on the fuselage near your turret. The trouble light (C) is on the front lefthand corner of the controller housing.

The Bendix Upper's manual system can be used only for moving the turret to make repairs and adjustments: it is not designed for operating the turret in combat emergencies. A single crank with a flexible shaft, stored at the base of the turret, is used to move the turret in either azimuth or elevation. To move the guns up or down, put the crank on the elevation shaft (D) in front of the sight cradle. To rotate the turret, you will have to get down in the turret and put the crank on the pinion shaft (E) in the azimuth gearing at the base of the main support column.



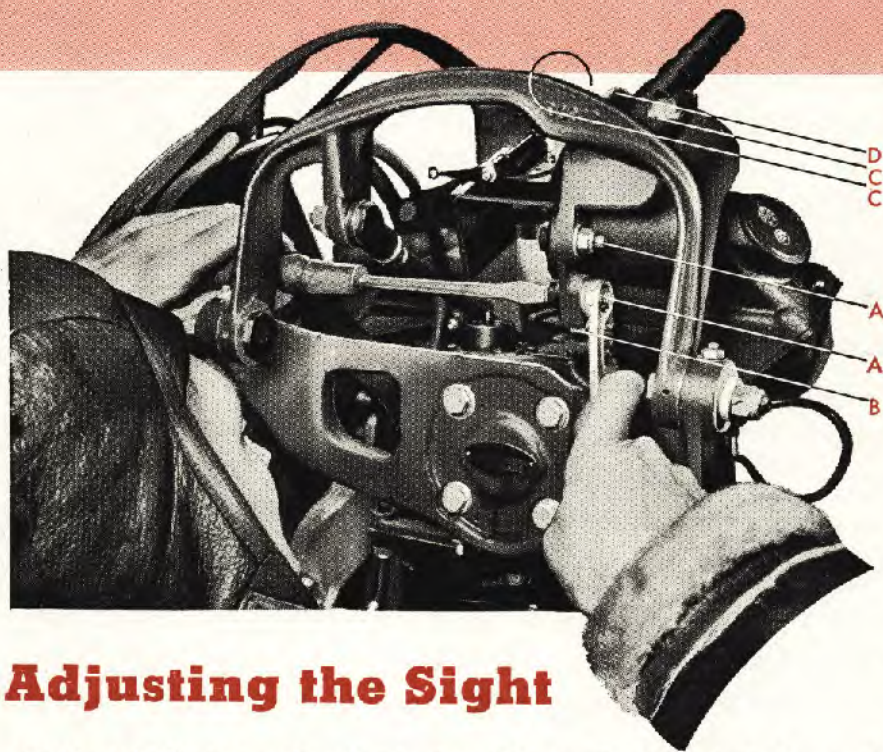
Getting Out

Before leaving the turret, move it to stowing position—guns pointing straight back toward the tail. Turn off all the switches. Then slide down off the seat and back out of the turret. Once you are out, unlatch and stow the seat.

Preparing the Turret for Combat

The preceding pages have illustrated how to get into the Bendix Upper, operate it, and how to get out again. With this information, you could easily take over the turret in combat.

If you specialize in the Bendix, however, you will have to adjust the sight and guns for a mission, and load ammunition. The method of getting the turret ready for action is explained on the following pages.



Adjusting the Sight

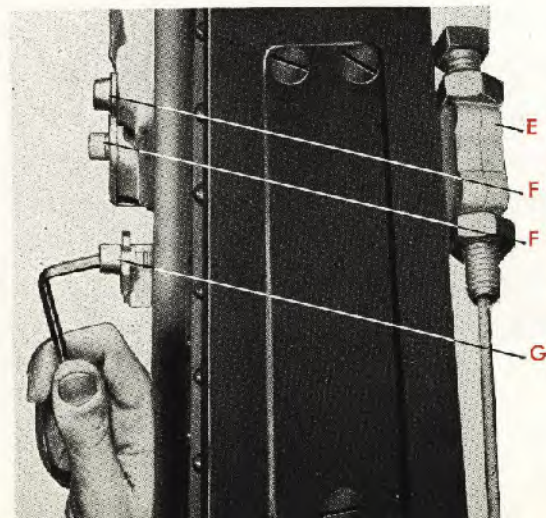
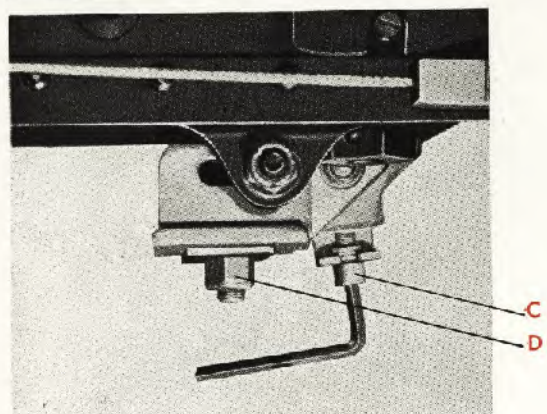
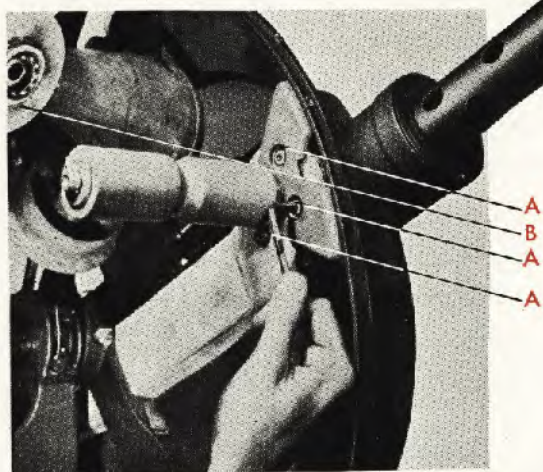
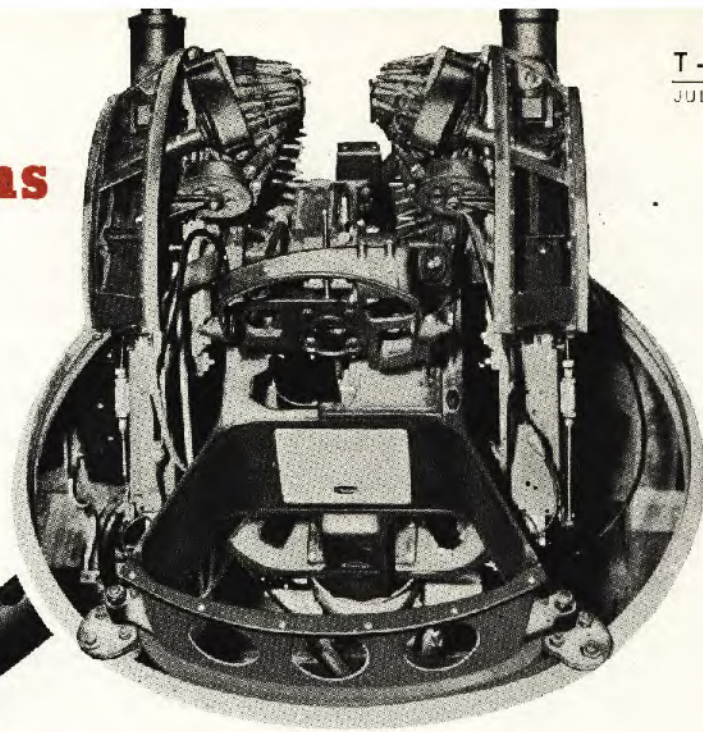
The Bendix Upper's N-8 or N-6A sight fits into a bracket in the sight cradle directly in front of you. To adjust the position of the sight, as may sometimes be necessary in harmonizing the guns, loosen the mounting bolts and turn the adjusting bolts you will find nearby. The two mounting bolts directly in front (A) hold the sight vertically in its bracket; the adjusting bolt (B) directly beneath them moves the sight up or down. The two mounting bolts at the top (C) hold the sight in place laterally; the adjusting bolt (D) in front of them moves the sight from side to side.

For full instructions on care and checking of the sight, see the Sights and Sighting section.

Adjusting the Guns

The guns are mounted in the Bendix Upper to feed from the inside—the right gun feeds from the left and the left gun from the right.

Each gun is held in its cradle by a front gun yoke and rear bracket. The front is held by two studs that must be safety wired. A recoil guide stud, bolted to the rear of the gun, fits into a hole in the rear mounting bracket, held underneath by an elastic stop nut.



Special charging units (E) operated by your footrests, are mounted on the outside of the guns' receivers; their mounting bolts must be safety wired. Special case ejection chutes are installed on the outside of the guns to carry used links away from the guns; the hollow pins holding the chutes in the guns must have cotter pins. Special ammunition feed rollers (B) are mounted on top of each gun and held by the gun cover pin, which must have a cotter key.

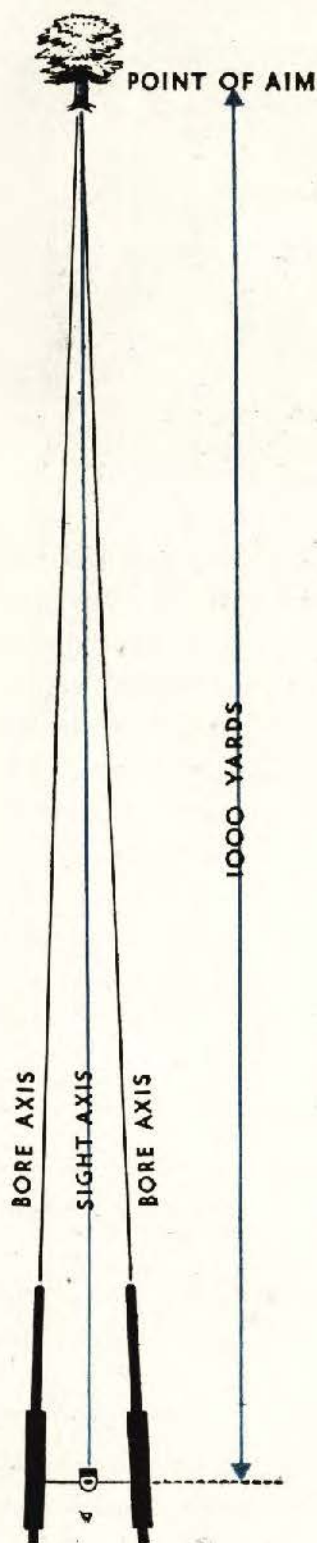
The guns are adjusted up, down, or sideways in their cradles by means of two Allen adjusting screws in each rear mount, held by two rear and four front mount lock screws.

To make the adjustment:

- 1 Loosen the rear mount elastic stop nut (D), the two rear Allen lock screws (F), and four front lock screws (A) with an Allen wrench.
- 2 Turn the bottom vertical adjustment screw (C) with the Allen wrench right or left to move the rear of the gun up or down.
- 3 Turn the inside rear lateral adjustment screw (G) right or left to move the rear of the gun from side to side.
- 4 Tighten the rear elastic stop nut and all lock screws, front and rear.

By means of these adjustments the guns can be centered in their mounts. Turn the adjustment screws to the centers of their vertical and lateral adjustments.

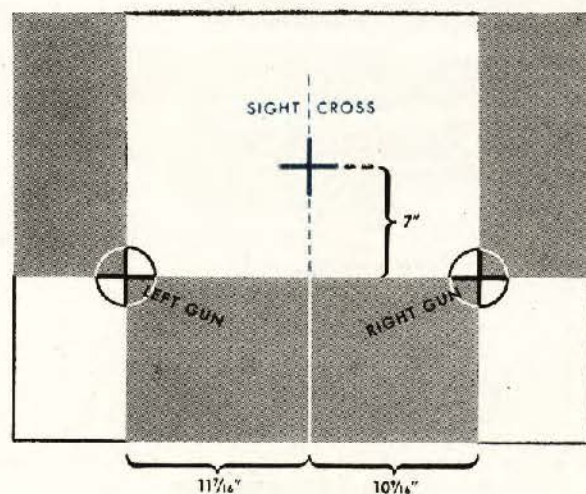
Harmonizing the Guns



There are a number of ways to harmonize the sight and guns in the Bendix Upper Deck Turret. The exact procedure will be defined by the Squadron Gunnery Officer. A handy method is to line up the sight and boresight the guns on some small object such as a tree or chimney, at least 1,000 yards away. You will need an assistant in the turret and a muzzle-type boresight tool to do this.

FIRST, have your assistant move the turret until the dot of the sight is centered on the object. Place the boresight tool in one gun, and have your assistant adjust its rear mount until the same object is exactly centered in the gun bore. Then do the same for the other gun. Sometimes there may not be enough adjustment in the gun mounts. In that case, center the guns in their mounts and boresight each gun on the object. Then move the sight by its adjustment bolts until the dot is on the same object.

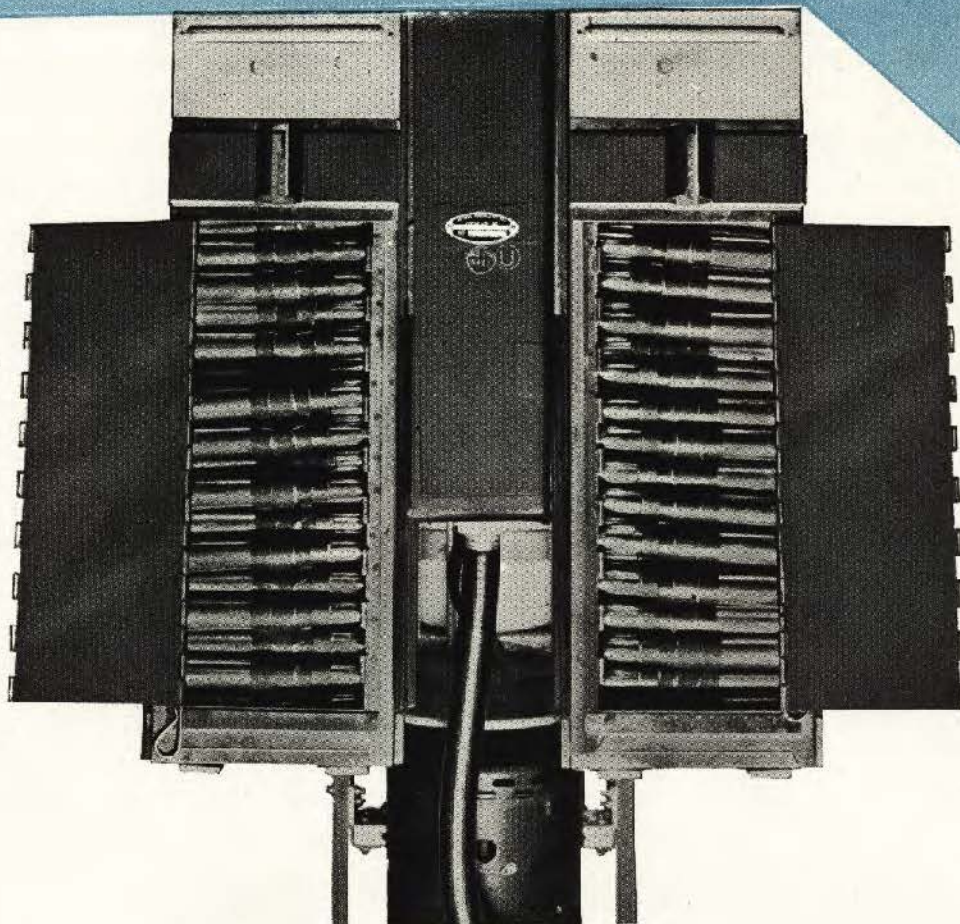
IMPORTANT: Check harmonization by swinging the turret on another small object off to one side, 1,000 yards away, and boresighting to make sure sight and guns all line up on the same object. Select another object and check again. If sight and guns are out of line on any object, call in turret maintenance.



Another method of harmonizing the Bendix Upper is to boresight on a pattern stand, such as the one illustrated here. Set up the stand level with the guns at least 50 yards away. Center the guns in their mounts. Then boresight the guns on the pattern and line up the sight on the sight cross, using the standard technique described in the Sights and Sighting section.

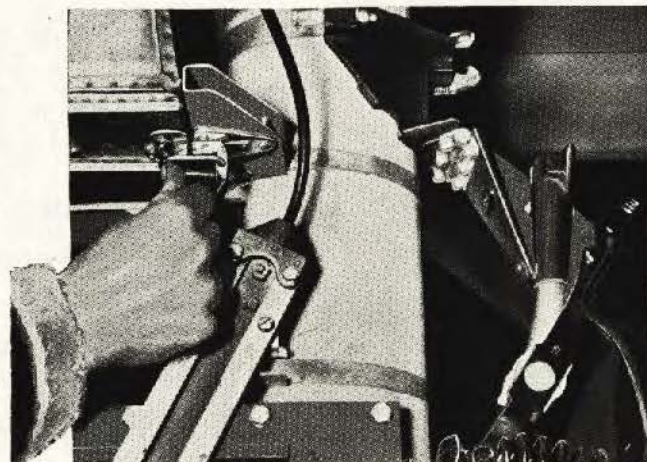
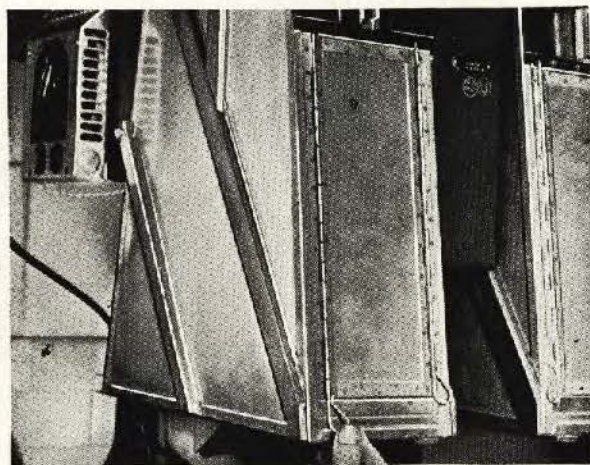
Both methods described here are parallel harmonization.

Loading Ammunition



Two big ammunition cans, one marked for the right gun and the other for the left, hold about 400 rounds apiece. They hook on the inside of the big ring casting circling your head and

hang down on either side of the center column. Load them in the standard fold-in pattern, single-link end first, making sure the rounds will point toward the center of the turret when the

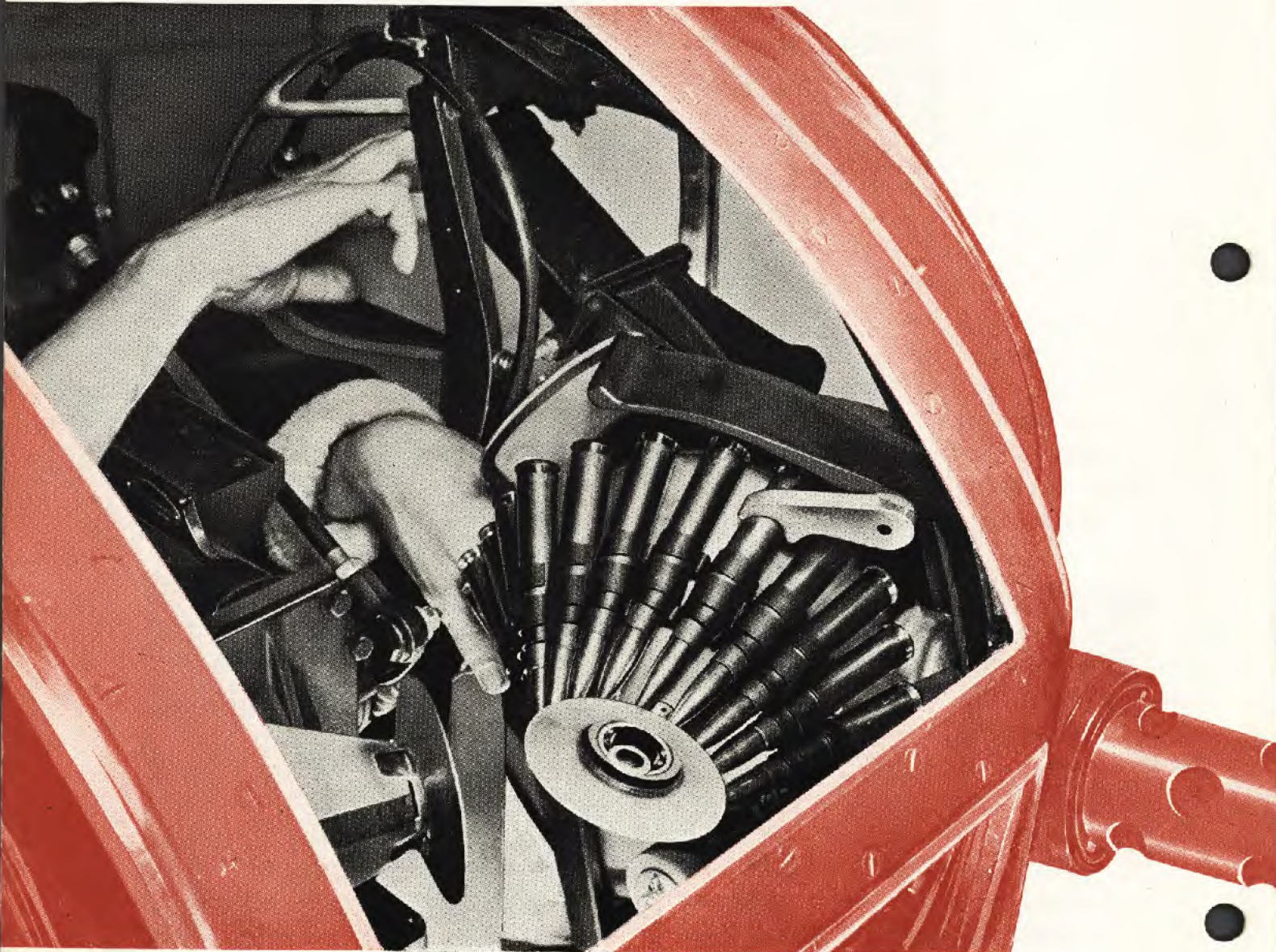


cans are hung up on the inner rim of the turret. Place the loaded cans on the turret floor, right below where they will hang. Then lift each can straight up, using one knee as a support under the can. On the top edge of each can is a bar which must hook into the support hook on the front of the main turret casting.

At the bottom rear of each can is a bar which fits into a bracket on the controller housing, held there by latch pin. Push the pin all the way in, then give it a quarter turn to lock it.

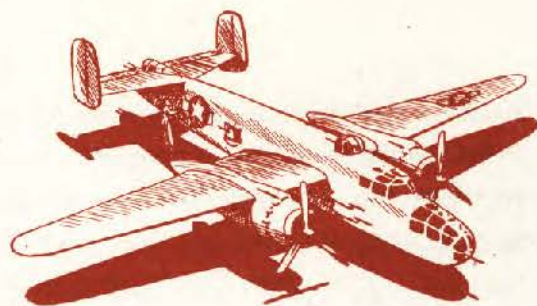
After the cans are securely in place, pull the double-link end of each ammunition belt over the top of the ammunition rollers, keeping the cartridge points toward the small ends of the rollers. Pull the belt over the top of the cone feed rollers. Then, twisting the belts slightly, bring them up around the guide rollers. Force the first rounds into the feedways.

Two spent round bags, to receive used brass ejected from the guns, hook to the mouth of the guns' case ejection chutes.



Pre-Flight Routine

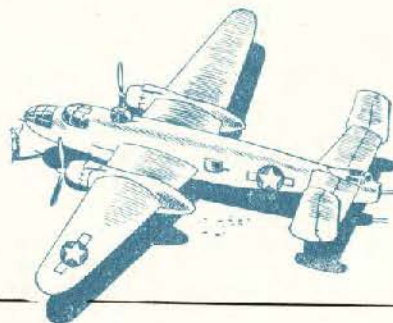
... Follow Step by Step



1. Make sure the gun bolts are properly assembled, one for left-hand feed in the right gun, the other for right-hand feed in the left gun. Then install the bolt, barrel, oil buffer, and backplate groups in both guns.
2. Try to rock the guns in their cradles to make sure they are securely mounted. Check the front and rear studs and mounting bolts to make sure that they are properly safety wired and tight.
3. Inspect the charging units to make sure that they are securely mounted and safety wired.
4. Inspect the ammunition rollers and case ejection chutes to make sure they are properly mounted and the pins holding them have cotter pins and keys.
5. Check harmonization with a boresight tool by boresighting the sight and guns on some small object at least 1,000 yards away, or on a pattern stand. Double-check by boresighting on two or three other objects.
6. Inspect the electric cables. Make sure all cannon plug connections are tight. Report any frayed or damaged cables. Take particular note of the interphone cable on the right side of the controller housing to make sure it is not loose or frayed.
7. Inspect your ammunition belts to make sure the rounds are in good condition and properly belted.
8. Load the ammunition cans and lift them into place in the turret. Make sure the cans are hooked up securely in front, and the latch pins are locked at the bottom rear of the cans. Open the inspection doors in the front of the cans to see that the ammunition is correctly placed in the cans, with the cartridge points facing toward the center of the turret.
9. Pull the ammunition belts up over the lead rollers, then over the cone rollers, and twist them slightly over the guide rollers leading up to the guns' feedways. Don't insert the first rounds in the feedways as yet.
10. Adjust the footrests, if necessary, and raise the seat if you wish—making sure that the seat is securely latched up in place. Get into the turret.
11. Make sure the dome is clean.
12. Reach out to the left wall of the fuselage and turn on the main power switch and heat-light switch.
13. Turn on the sight rheostat and turn it from dim to bright to adjust the brightness of the light and make sure it is working properly. Flip the sight filament switch to both positions to make sure both filaments in the sight bulb are working. If either filament is burned out, replace the bulb. Make sure the optic head is clean.
14. Make sure there is no ammunition in the gun chambers. Charge the guns by lifting up and stepping down sharply on the footrest. Check the guns' headspace. Then test your triggers by pulling one at a time, charging the guns each time and checking the adjust-

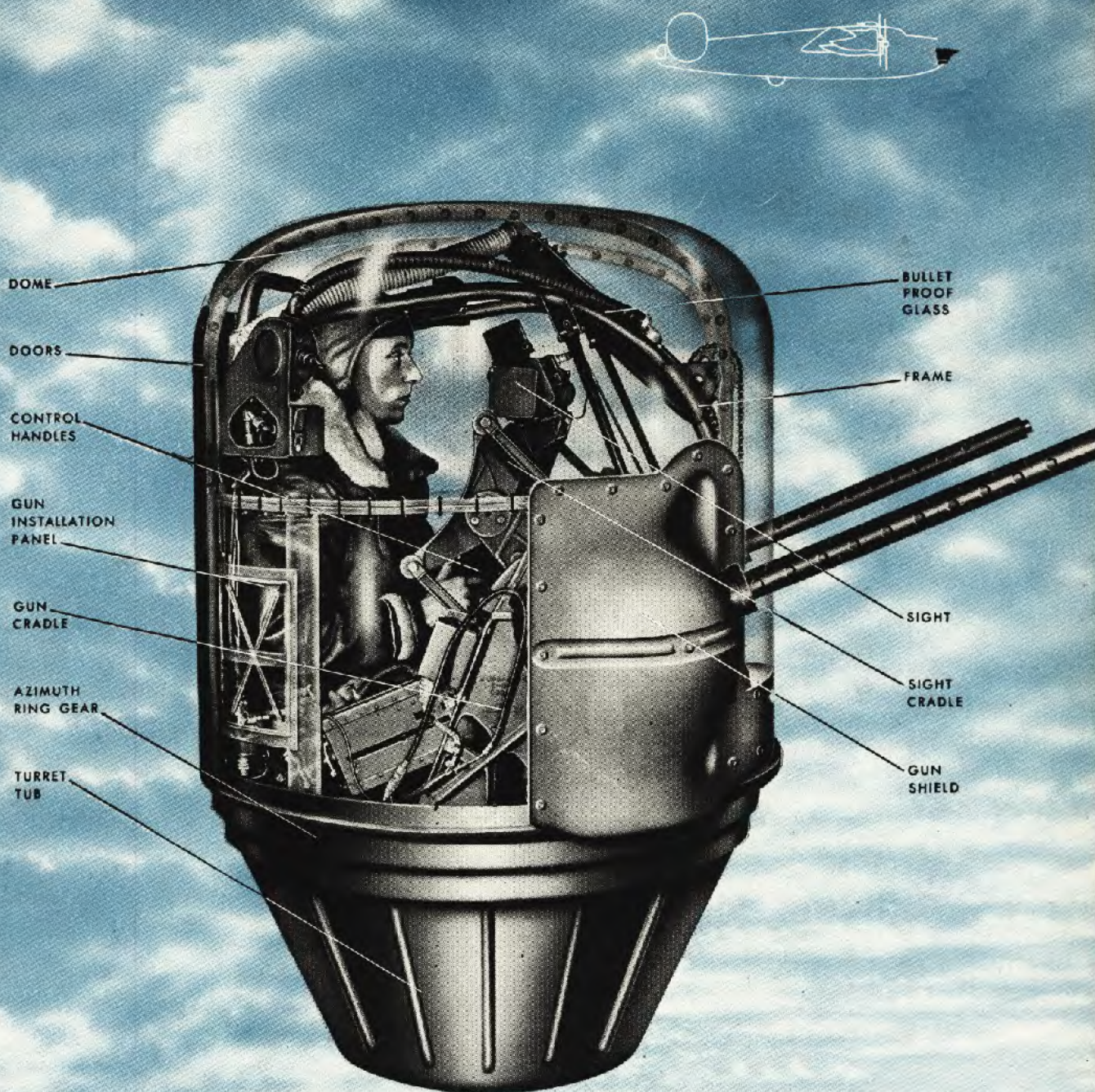
ment of the electric triggers. Listen for a "click" as the firing pins in the guns release. Both guns should fire from either trigger.

15. Run the turret under power in azimuth and elevation at normal speed and then with the high speed button held down, to check on ease of operation. Make sure the turret runs with either safety switch held down. Test the limit stops (called brakes on the Bendix) by attempting to bring the guns down on the fuselage forward and backward. Then stop the turret suddenly and check for creep.
16. Check the fire cutoff system by swinging the turret and guns on the tail and propeller areas of the plane, charging and attempting to fire the guns on each area. Make sure the guns stop firing with the proper amount of safety margin around all sides of the restricted areas—your crew chief will tell you how much.
17. Plug in your headphones and microphone to test whether your crew mates can hear you and you can hear them.
18. Plug in and test your heated suit and the rheostat. Make sure the rheostat controls the amount of heat by turning it to various positions on the dial.
19. Make sure your trouble light operates. Flip on the switch. Pull the light out on its cord all the way to make sure the retractable reel is working properly.
20. Make a final visual check of the turret, inside and out.
21. Just before takeoff, press the first rounds of the ammunition belts into the guns' feedways over the belt holding pawls. In flight, charge both guns on the order of the flight commander.



Post-Flight

1. Run the turret to its stowing position—guns level and pointing straight back on the tail.
2. Clear the guns by opening the gun covers and then charging them twice.
3. Shut off all switches.
4. Remove ammunition from the feedways and all ammunition from the turret.
5. Remove and empty the bags which receive spent rounds and links from the case ejection chutes.
6. Field strip the guns.
7. Clean and inspect the gun casing groups, following the procedure outlined under the post-flight check in the Guns section of this manual.
8. Detail strip the parts removed from the guns, cleaning them and making a thorough check on their condition, as outlined in the Guns section.
9. Report any malfunctions of turret or guns noted on the mission.



THE EMERSON BOW

EMERSON 250CE-1

The Emerson Bow Turret, located in the bow position of a number of PB4Y Liberator bombers, can swing a large cone of fire around the whole forward area of the airplane. It is a relative of the Consolidated Tail, and has many points of similarity in design and action. If you are acquainted with the Consolidated, you will feel right at home in the Emerson, though its actual operation is quite different. There is one model—the Emerson 250CE-1.

Facts and Figures



AZIMUTH

The turret moves in azimuth about 75 degrees to either side of the ship's center line.

SPEED

The turret has two speeds—normal tracking speed and high speed.

ARMOR

A heavy plate of bulletproof glass, which moves up and down with the guns, helps protect the gunner. Below is a large panel of armor plate, $\frac{5}{8}$ inch thick in some places and $\frac{3}{8}$ inch in others.

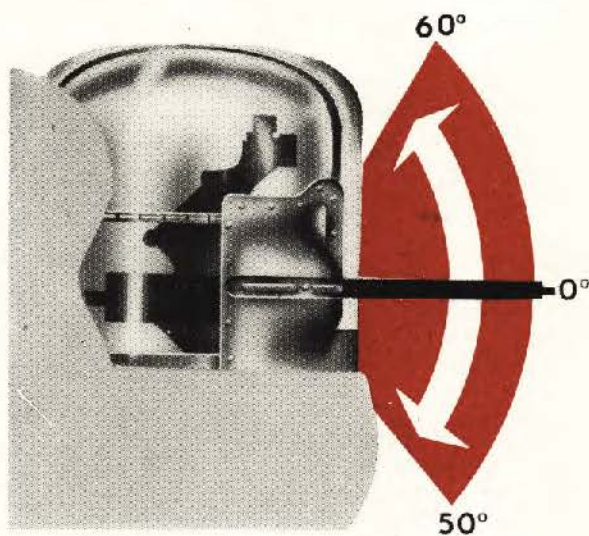


POWER

The Emerson is all-electric, operating on power supplied by the bomber's central electrical system.

SIGHT

Its sight is the N-8 or N-6A optical, described in the Sights and Sighting section of this manual.



ELEVATION

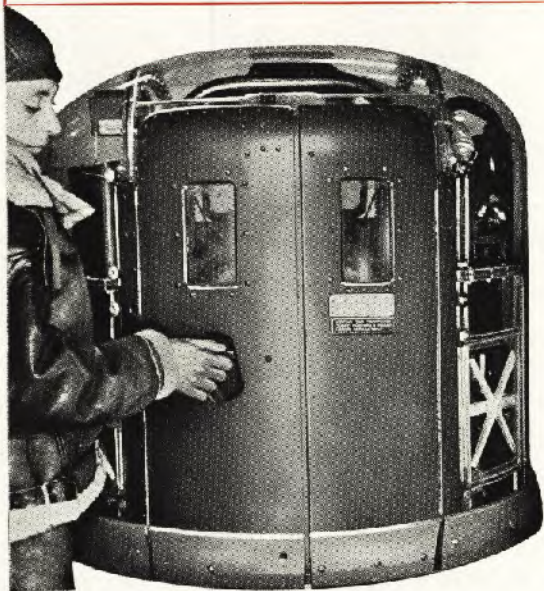
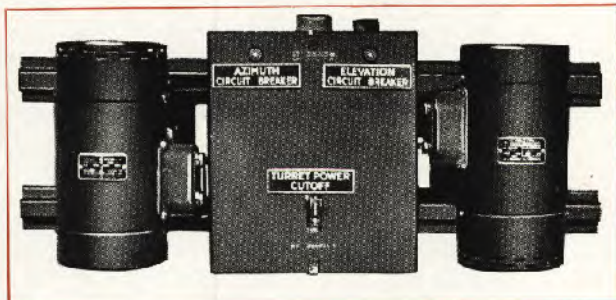
In elevation, the turret guns can be lowered and raised from 50 degrees below the horizontal level to 60 degrees above horizontal.

STOWING POSITION

The stowing position is 0 degrees azimuth and 0 degrees elevation—guns pointing directly forward.

Getting In

As you start getting acquainted with the Emerson Bow Turret, remember first of all that it is no place to be hanging around on takeoffs or landings. Quick changes of speed as the bomber leaves or approaches the ground make the turret a dangerous place at those times. On a mission, always get in after the plane is in full flight and get out before the landing. You will have to be careful as you step in. The only way to get in is illustrated here.

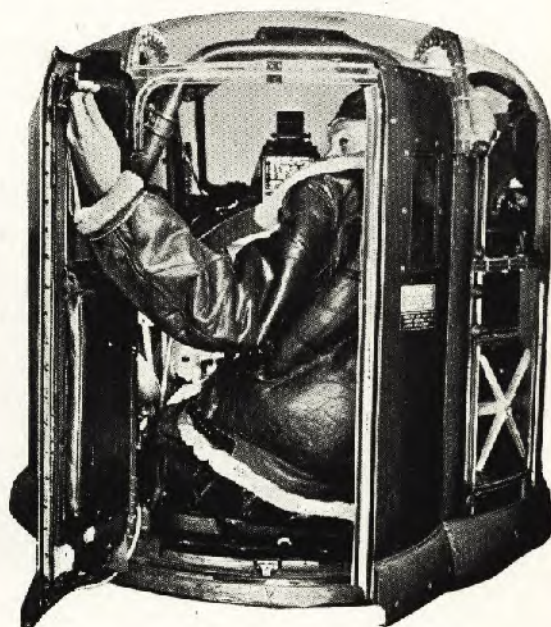
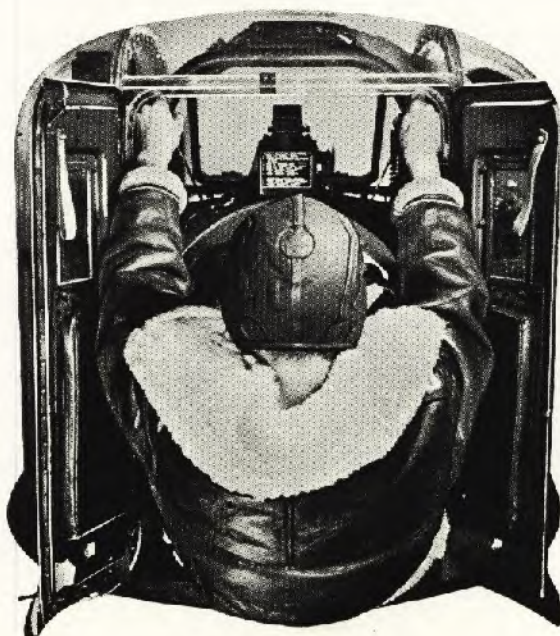


1 First check the power switch mounted outside the turret, on a box which you will find on the fuselage wall just left of the nose wheel. Make sure it is on. (In many planes, the switch is safety wired in the ON position.)

2 Then open the turret doors and look in to check the switch box on the left rear support. Make sure that all the switches are off—so that the turret cannot move and trap you while you are in the doorway.

3 After you are sure the switches are off, grasp the support above the doorway, chin yourself on it, and swing both feet straight into the turret pit. Slide into the seat.

4 Finally, reach back and close the doors behind you. Make sure they are securely latched. Then you are ready to operate the turret.





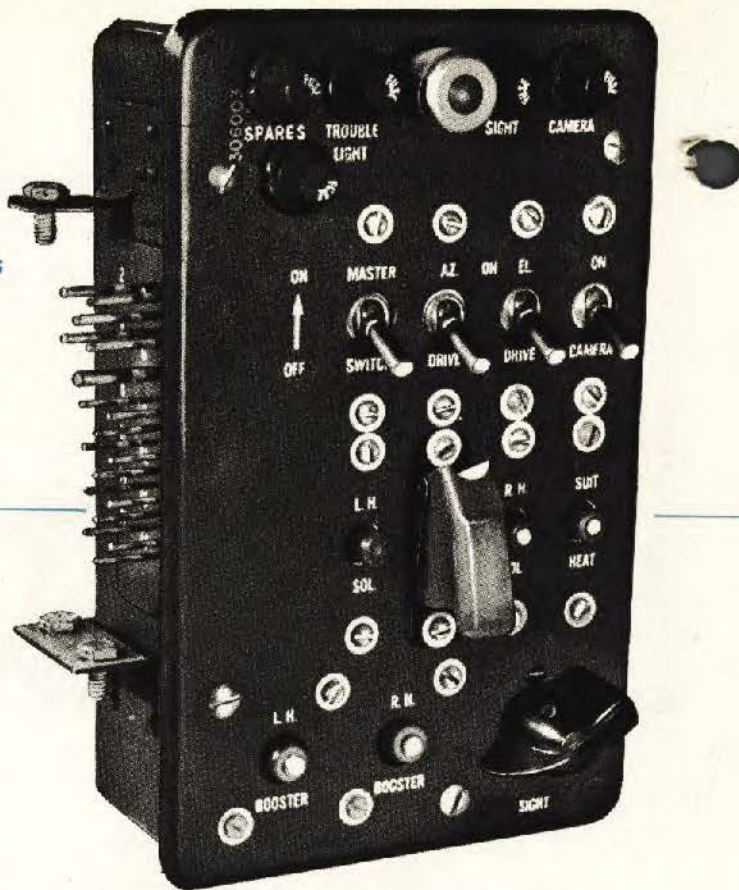
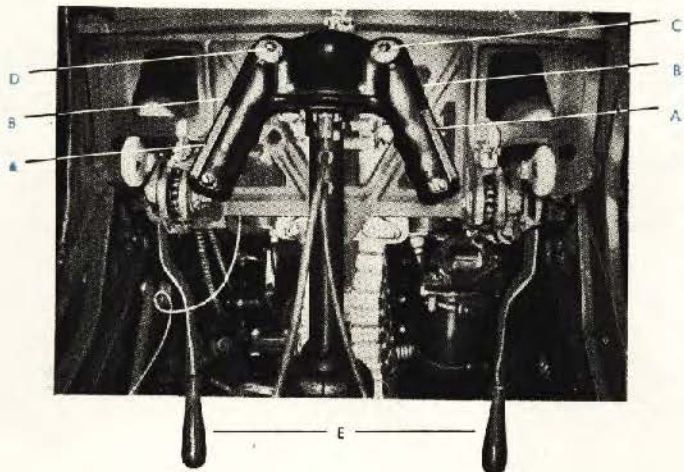
Operating the Turret

... where to find the controls
... how to use them

The switch box — now over your left shoulder—holds all the switches to run the turret.

First turn on the **master switch**, then the **azimuth drive switch** right beside it. Wait a few seconds, then turn on the **elevation drive switch**. Just below these three switches is a red plastic cover: under it is the **gun switch**, which must be turned on next. Then turn on the **camera switch**, if you need it. Finally, grasp the control handles in front of you, using the bottom edges of your hands to press down the two safety switches (A). The turret won't operate and the sight won't light up unless at least one of these switches is held down. Hold one handle while reaching back to the switch box to turn the **sight rheostat** to adjust the brilliance of light in the sight. (In some later Emersons, the sight operates independently of the safety switches.)

To operate the turret, simply turn the handles as you would steer a bicycle—to the right to go right, left to go left. Press down on the heels of the handles to raise the guns, and pull up



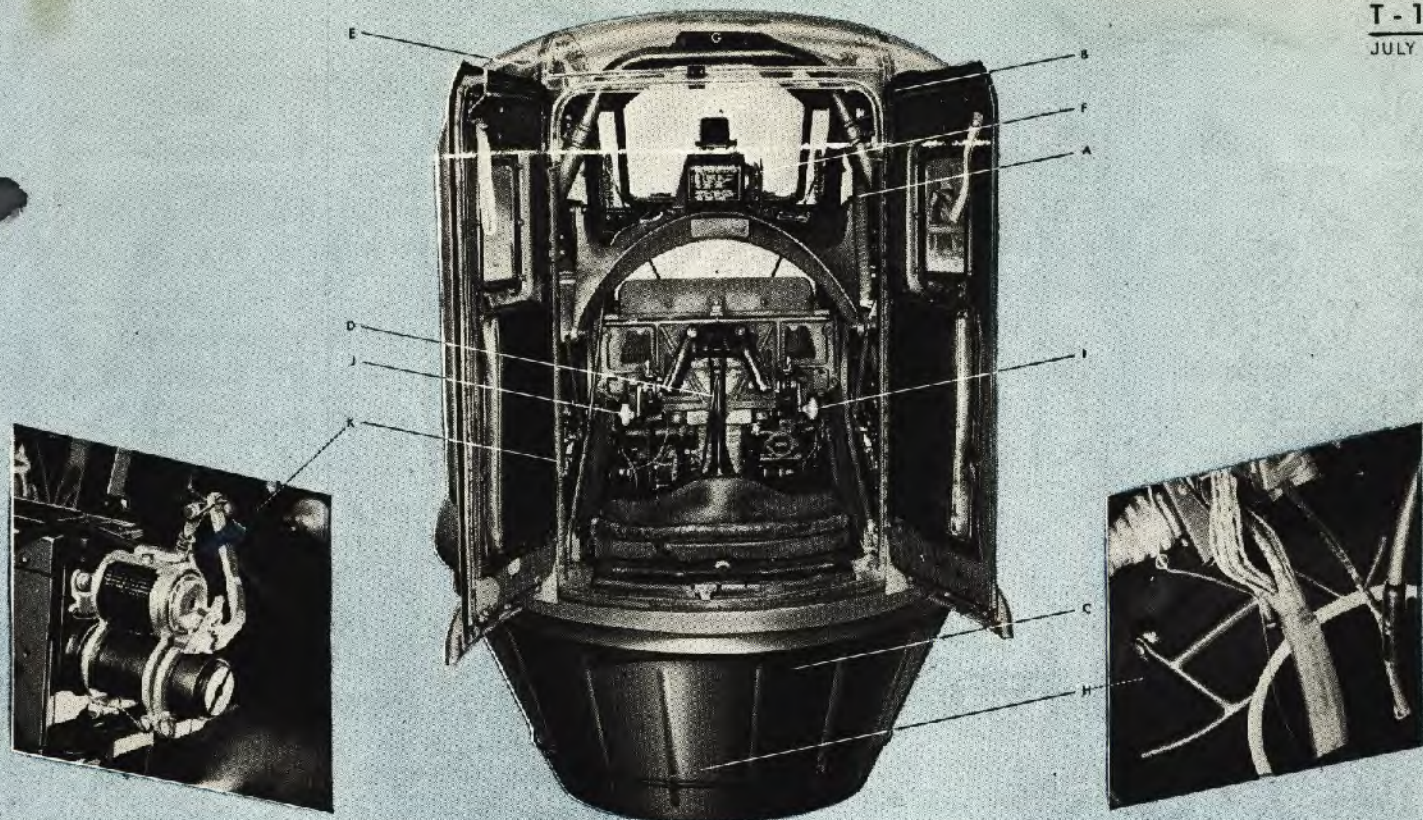
on them to lower the guns. Don't jerk the controls. Move them smoothly.

The other controls you will need in combat are right at your fingertips. Right under your index fingers on both handles are the triggers (B). On top of the right handle next to your thumb is the **high speed button** (C) that throws the turret into high speed for changing from one target to another.

On top of the left handle next to your thumb is the **push-to-talk button** (D) that opens the interphone system for you to speak.

Near your knees are charging levers (E) for hand charging the guns. To use them, pull them up sharply, then release them and let them drop back by themselves.

The Emerson has fuses to protect some electrical circuits, reset buttons to protect others. Most of them are on the switch box, with spare fuses in the upper left corner. Reset buttons for the azimuth and elevation power circuits are on the junction box outside the turret.



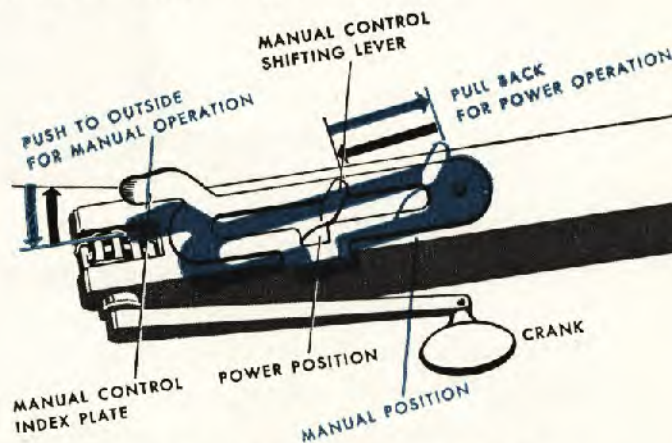
Using the Auxiliary Units

For your oxygen mask, you will find a hose connection leading from a demand type regulator (A) mounted on the support framework near your right shoulder. Alongside is a flow and pressure gage (B). Oxygen is supplied from the bomber's central tanks.

The heated suit plug-in (C) is mounted near your right foot on the wall of the turret tub. Jacks (D) for plugging in your earphones and microphone lead out of the column mounting the control handles. The jack box is outside the turret in the bombardier's compartment.

You will find the trouble light (E) and switch on the top left support tubing, and a gun camera bracket (F) to the right of the sight. At the top of the bulletproof glass is an electric heater (G) to keep the glass clear at low temperatures. The mechanism for operating the turret by hand in emergencies includes a foot-firing pedal (H), which permits you to fire the guns while your hands are occupied.

You will find the azimuth hand crank (I) in a bracket near your left knee, and the elevation hand crank (J) near your right knee.



To shift to manual operation:

- 1 Turn off all switches,
- 2 Press the manual control index plates on both hand crank brackets outward to their manual positions.
- 3 Press down the foot trigger firing keys (K) on each electric trigger.

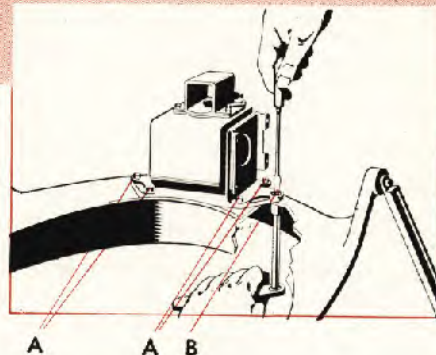
Getting Out

When you are ready to leave the turret, run it to stowing position—guns pointing straight ahead. Then turn off all switches. Open the doors behind you and step out of the turret. Then close the doors and make sure they are securely latched.

The Emerson has a special feature called the **emergency azimuth control**, which enables your crew mates to help you out of the turret in case of accident. By pulling on a cable leading out of the turret, they can disengage the azimuth power system. Then, using a hand crank which is kept in a bracket beneath the door, they can move the turret in azimuth by turning a shaft that sticks out of the bottom of the turret. Thus they can get the turret door into position to open it.

Preparing the Turret for Combat

At this point, you have read how to get into the turret, operate it, and get out. With this information, and practice, you could take over in combat. To be a specialist in the Emerson Nose, you will need additional instructions on how to get the sight and guns ready for a mission, and load the ammunition. You will find this information in the following pages.



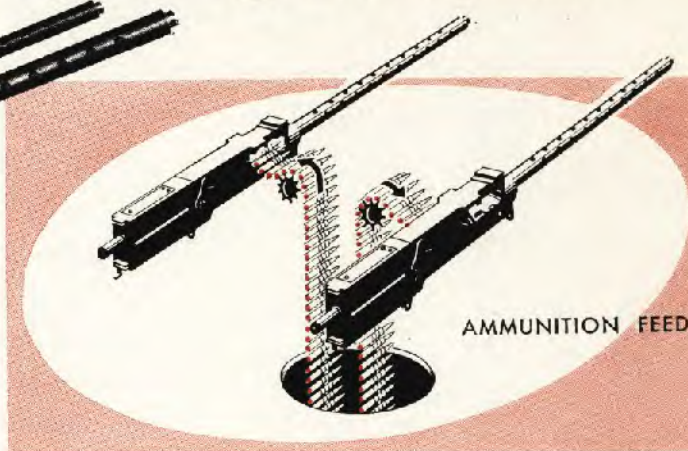
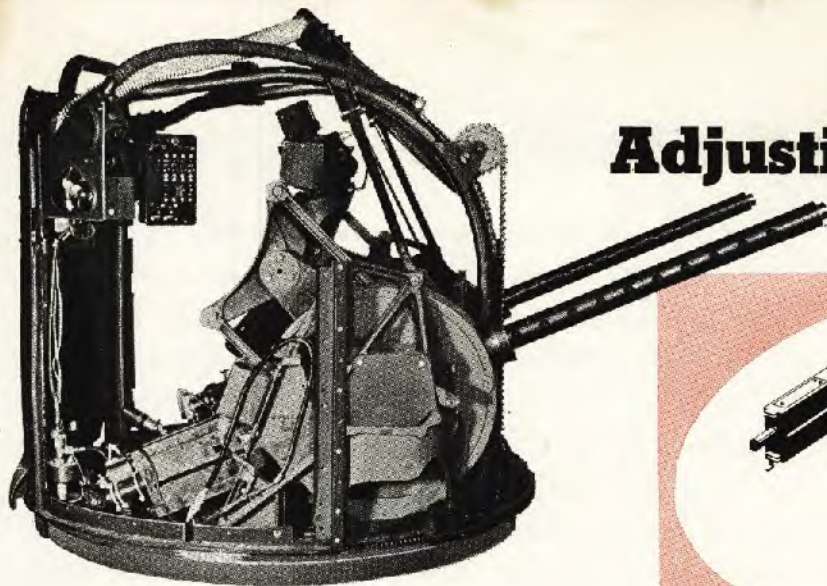
Adjusting the Sight

The Emerson Nose Turret's N-8 or N-6A optical sight is held by five mounting bolts on top of the sight cradle directly in front of you.

To adjust the position of the sight, as may sometimes be necessary in harmonizing it with the guns, the bolt at your extreme right serves as an adjusting bolt for moving the sight sideways to left or right. Loosen all the mounting bolts (A), but do not remove them. Then reach under the cradle, loosen the nut which holds the adjusting bolt (B), and move the bolt right or left with a screwdriver. When you have the sight in position, tighten the adjustment nut and all five bolts. No up or down adjustments can be made.

For full instructions on care of the sight and checking it before and after missions, see the Sights and Sighting section of this manual.

Adjusting the Guns

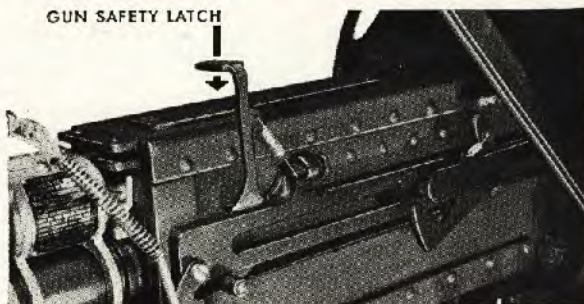


The guns are mounted in the Emerson to feed from the inside—the right gun from the left, the left gun from the right.

Each gun is held in its cradle by a rear mount block and slide, and a front gun mount. The rear mount block, bolted to the rear of the gun, dovetails into the slide in the cradle—simply check to make sure it fits. The front gun mount is a jaw-like affair that snaps over two bearing pins on the gun's adapter, and is locked in place by a gun release handle on the inside of the cradle. This handle, or lever, is safety wired to the gun shield in its up or locked position. Special charging units are mounted on the inside of the guns; their mounting bolts must be safety wired and the cable connections to the units must have cotter pins. Sticking up from each charging unit is a special gun safety latch for holding the bolt in its retracted position after charging—push it down before charging, pull it up when ready to fire. Foot-firing mechanisms, mounted on the buffer tubes of the guns, must have their mounting bolts safety wired. For adjusting the guns up, down, or sideways in their cradles, the rear mounts have bolt and screw adjustment assemblies.

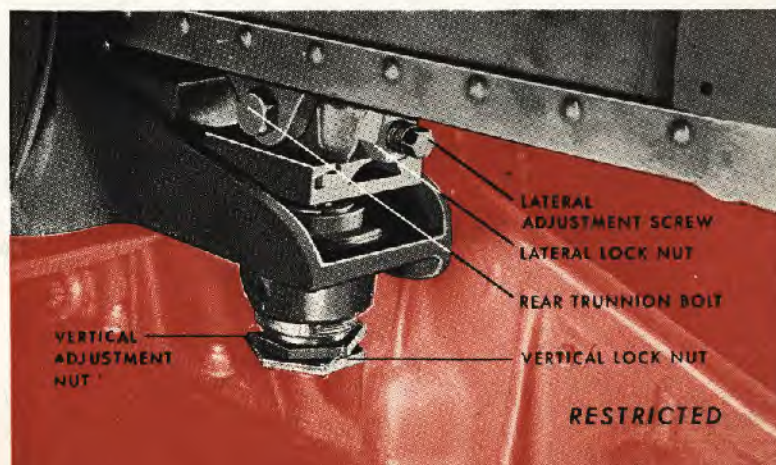
To make a vertical adjustment, first loosen the lock nut on the bottom adjustment bolt. Then turn the vertical adjustment collar just above

GUN SAFETY LATCH

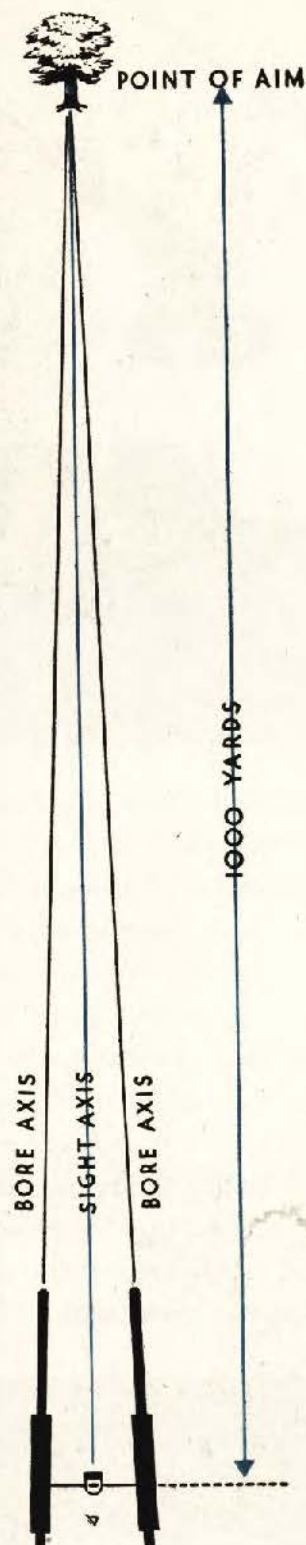


the nut to raise or lower the back of the gun. Tighten and safety wire the lock nut.

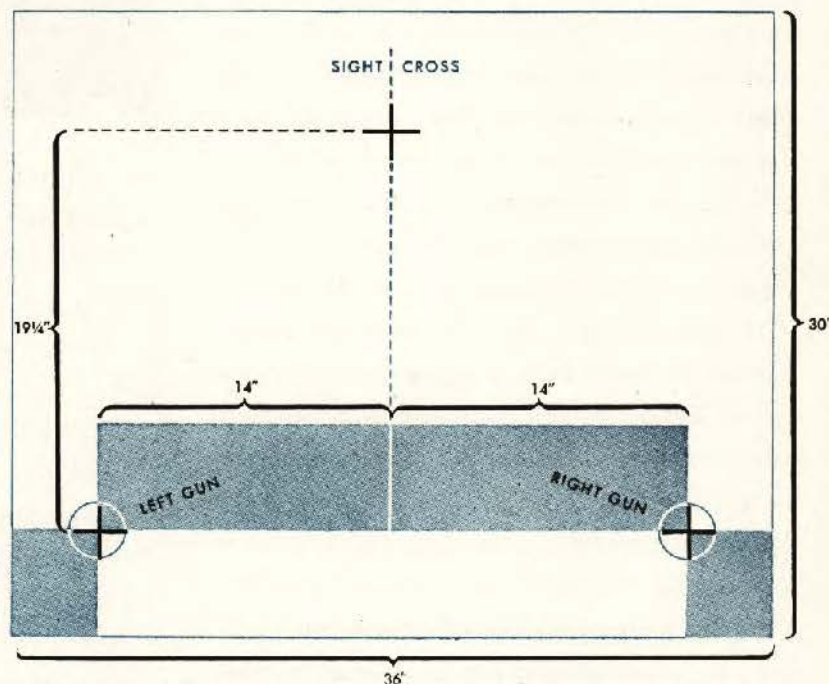
To make a lateral adjustment, first loosen the lock nut on the lateral adjustment screw, and loosen the screw not over one full turn. Then loosen the nut on the rear mounting bolt and turn the bolt to move the back of the gun from side to side. Tighten the rear mounting bolt nut, then the adjustment screw and lock nut. By means of these adjustments the guns can be centered in their mounts. Turn the vertical adjustment collar and rear trunnion bolt to the centers of their adjustment movements.



Harmonizing the Guns and Sight



There are a number of ways to harmonize the guns and sight of the Emerson Bow Turret. The exact procedure will be defined by the Squadron Gunnery Officer. A handy method is to line up the sight and boresight the guns on some small object such as a tree or chimney, at least 1,000 yards from the plane. First line up the sight on the object selected, moving the turret by hand crank until the dot of the sight is squarely on the object. Don't move the turret after this. Then, using a boresight reflector, boresight through each gun barrel while adjusting each gun by its rear mount adjustment collar and bolt assembly until the same spot the sight is sighted on is in the exact center of each gun bore. (A boresight reflector must be used because there isn't enough space in the nose to sight directly through the gun barrels.) Tighten and safety wire the rear mount lock nuts and bolts.



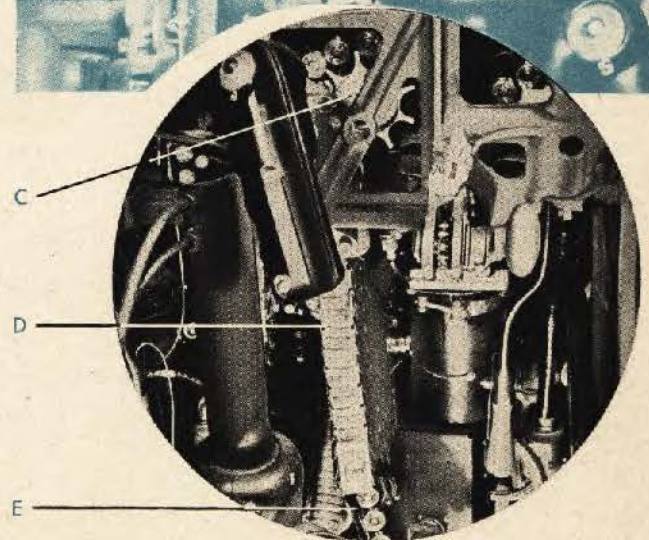
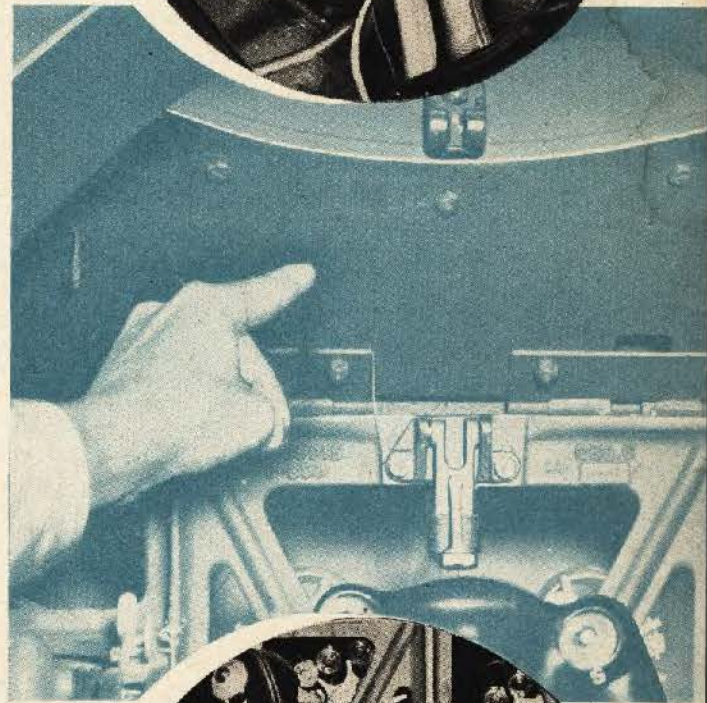
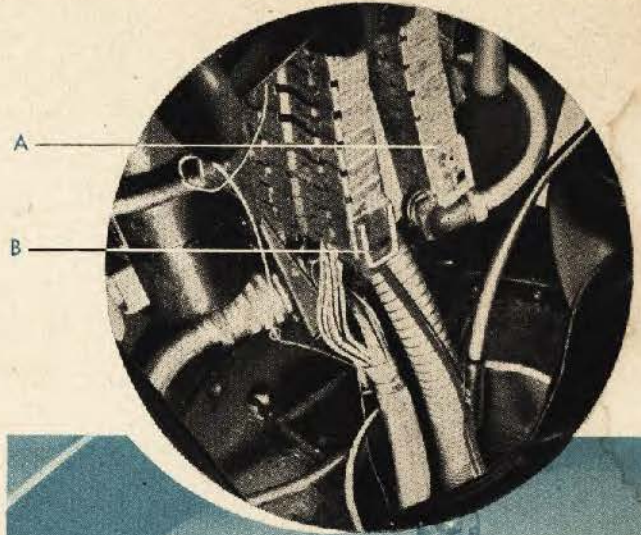
Another method of harmonizing the Emerson is to boresight on a special pattern stand, such as the one illustrated here. Set up the pattern stand level with the guns at least 50 yards from the plane. Center the guns in their mounts. Then line up the sight to center the dot on the sight cross and boresight the guns on the pattern, using the standard technique described in the Sight and Sighting section of this manual. Both methods described here are parallel harmonization.

Loading Ammunition

Two ammunition cans, one for each gun, ride outside the turret along the right and left fuselage wall. Chutes carry the ammunition belts from the cans up through the floor of the turret to the guns. Each can is loaded in the standard folded pattern, starting at the corner of the can farthest from the turret, single-link end of the belt first, rounds pointing toward the outside of the plane.

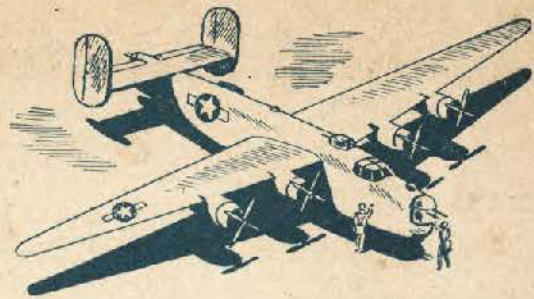
To get each belt to the gun, force it up through its chute, double-link end first, until the first round starts up the vertical section of the chute into the turret.

Inside the turret, you will find a joint in the vertical section of the chutes (A, B). Break the chutes apart at the joints, and with a piece of hooked wire reach down and haul the belt up. For the next step you will need two extra lengths of belt of about 25 rounds to use as feed strips. First, open the latch on the armor plate in front of you and lift the plate up out of the way. Then drop a piece of hooked wire down the upper chutes (D) and pull the feed strips up over the booster sprockets (C) to the guns, double-link end first. Make sure the rounds point forward. Close the armor panel. Finally, connect the bottom of the feed strips (E) to the main ammunition belts. Make sure that the connecting rounds are evenly shoved into the links. Then re-fasten the chutes at the joints. Just before the takeoff open the armor plate panel again and press the double-link end of each belt into each guns' feedway. Close the armor plate panel, and, after hand charging twice, the guns are ready to fire.



Pre-Flight Routine

... follow it step by step



1. Make sure the gun bolts are properly assembled, one for left-hand feed in the right gun, the other for right-hand feed in the left gun. Then remove the two plexiglas gun installation panels on each side of the turret door, and install the bolt, barrel, oil buffer, and backplate groups.
2. Try to rock the guns in their cradles to make sure they are securely mounted. Check to make sure the rear mounting bolts are safety wired and the front gun release handles are safety wired to the gun shields in their up position.
3. Check the charging units on the inside of the guns to make sure their mounting bolts are safety wired and cable connections have cotter pins.
4. Check the foot-firing mechanisms on the guns' buffer tubes to make sure they are securely mounted and safety wired.
5. Check harmonization by boresighting the sight and guns on some small object at least 1,000 yards from the plane, or on a pattern stand.
6. While harmonizing the guns, make sure the manual system is working properly.
7. Inspect the electric cables. Make sure all cannon plug connections are tight and the main switch box is firmly seated. Report any frayed or damaged cables.
8. Check the oxygen connections to make sure they are tight.
9. Inspect the ammunition belts to make sure the rounds are in good condition and properly belted.
10. Load the ammunition cans and force the belts up through the guide chutes until the first rounds start up the vertical chutes inside the turret.
11. Make sure the external power switch on the outside junction box is on.
12. Open the turret doors. Before entering, make sure all switches are off and the azimuth and elevation clutch levers are in their manual position. Then get into the turret, taking two ammunition feed strips with you.
13. Make sure the dome is clean.
14. Test the foot-firing mechanisms by charging the guns, pressing down the foot-firing keys on the back of each gun, and stepping on the foot-firing pedal. Listen for a click as the firing pins release.
15. Pull the azimuth and elevation clutch levers back into their power position. Then turn on the master switch.
16. Turn on the azimuth drive switch. Wait a few seconds, then turn on the elevation drive switch.
17. With one safety switch held down, turn the sight rheostat to check its operation and adjust the brightness of the sight. Flip the sight filament switch to both positions. If either filament of the sight bulb is burned out, replace the bulb. Make sure the optic head is clean.

18. Still holding the safety switch down, check the booster motors by tilting them toward the guns. The motors should cut on and off sharply, without lag.
19. Flip on the gun switch. Check headspace in the guns. Then pull one trigger at a time, charging the guns each time, to check electric triggers for proper adjustment. Listen for a click as the firing pins release. Either trigger should fire both guns.
20. Run the turret in azimuth and elevation at normal speed, then with the high speed button held down, to check on ease of operation. Make sure the turret runs with either safety switch held down. Check the limit stops to make sure the turret stops about 75 degrees on either side of the center line and about 60 degrees above and 50 degrees below horizontal. Watch for any binding in the up or down movement of the seat, sight, and bulletproof glass. Then stop the turret and check for creep.
21. Put on your oxygen mask, connect it, and test by turning on the direct flow valve. Check the gage to make sure there is proper pressure in the tanks, as determined by your crew chief. **Then close the valve.**
22. Plug in your headphones and microphone to test whether your crew mates can hear you and you can hear them.
23. Plug in and test your heated suit and rheostat.
24. Make sure the trouble light works. Pull the light out on its cord to make sure the retractable reel is working properly.
25. Break the two vertical ammunition chutes and pull two feed strips up through the chutes over the booster sprockets to the guns. Connect the feed strips to the ammunition belts in the lower chutes, and close the chutes at the breaks.
26. Turn off all switches, and move the clutches to their manual position. Get out of the turret, and make a last visual check of the turret, inside and out.
27. In flight, press the first rounds into the guns' feedways over the belt holding pawls. Charge the guns on order of the flight commander.

Before Landing

1. Run the turret into its stowing position—guns level and pointing straight forward.
2. Clear the guns by lifting the gun covers and hand charging them twice. Remove all ammunition from the feedways.
3. Shut off all switches and pull the clutches to their manual position.
4. Get out of the turret and close and latch the doors.

Post-Flight

1. Clear out all ammunition from the chutes and cans.
2. Field strip the guns.
3. Clean and inspect the gun casing groups, following the procedure outlined under post-flight checks in the Guns section of this manual.
4. Detail strip the parts removed from the guns, cleaning them and making a thorough check on the condition of their parts, as outlined in the Guns section.
5. Report any malfunctions of turret or guns noted on the mission.

NOTES
