POWER TURRETS

How to operate and take care of them

RESTRICTED

Thanks to the Turret . . .

THE BOMBER FIGHTS BACK

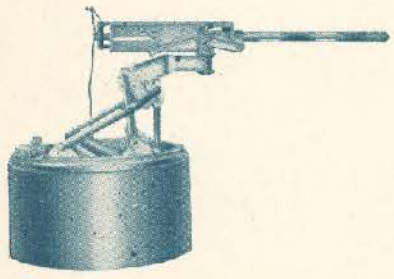
• Without the men who invented the turret, today's great bombing missions would be impossible. For without turrets, the bomber would be almost as helpless over enemy territory as an ordinary transport plane without a single gun.

• No one knows exactly who should get credit for inventing the modern turret. The first crude models came out in the 1920's. One was a circular mount, illustrated on this page, which the United States developed to put a little flexibility into bomber guns. The Russians tried a movable platform, cranked by hand, in which the gunner sat right out in the open, fighting the slipstream as well as the enemy.

• The modern power turret—driven by electricity and mounted inside the bomber—was developed after many experiments in the 1930's and proved its worth in action in the second year of World War II. Its effect on air strategy was spectacular. At last the bomber—heavier and slower than the fighter plane—could really fight back.

• For turrets—little blisters of plexiglas or safety glass, bristling with caliber .50s, swinging around to meet enemy fighters no matter where they come from—enable the bomber to match the enemy slug for slug in an air battle.

• Approach an American bomber today, from any angle, and you will see a turret whose guns could be turned toward you in an instant.



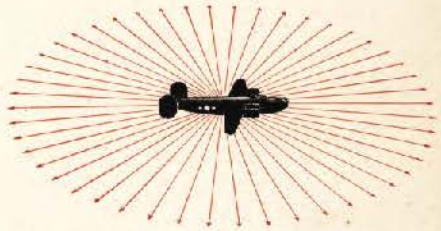
• The top turret swings in a full circle; its guns move up and down from straight out to nearly straight up; it protects the whole top of the plane.

• The lower ball turret swings in a full circle and points its guns anywhere from straight out to straight down; it can fight off any attacker who comes from below. The tail turret throws

out a big cone of fire toward the rear, and the nose or chin turret a heavy cone of fire straight ahead.

• Along with hand-held guns sticking out the waist windows and the radio position, the turrets cover almost every square inch of sky around the bomber. No matter where the enemy fighter comes from, he must take his chances with a hail of caliber .50 bullets.

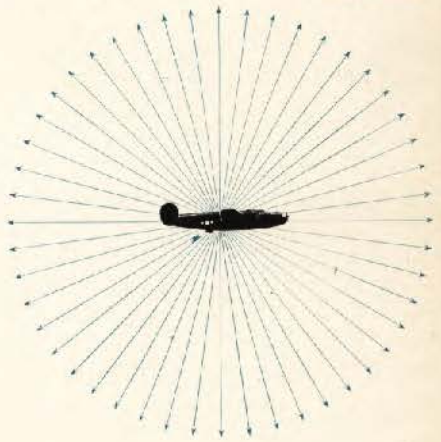
• The turrets are spun around, and the guns raised and lowered, by electric motors or by hydraulic pressure systems run by electric motors. (In the language of turrets, swinging from side to side is called moving in **azimuth;** up and down movement is called **elevation.**) All the gunner has to do is hold on to the control handles of his guns and move them to steer the turret; the mechanism does the rest.



AZIMUTH

. . . the turret covers every angle

ELEVATION



• Inside the turret is everything the gunner needs for combat, arranged so that he can get at it in an instant. No space is wasted; although turrets are small, they have everything it takes to fight the enemy.

• As a turret gunner—no matter which turret you are assigned to—you will ride into combat seated in back of caliber .50 machine guns and a sight. Often your seat and footrests will be adjustable; if so, learn to use the adjustments properly and you will find them a great aid to both your comfort and your efficiency.

• Armor plate or bulletproof glass will protect you as much as possible—though your best defense, like a good boxer's, will still be the offensive power packed by those caliber .50s.

• Your guns will be equipped with a special charging system —usually a pulley and cable—which makes it easy to hand charge them in the crowded space of the turret. The guns will be mounted in adapters which cushion their recoil. You will fire them by pressing triggers, usually under your index fingers on the control handles, which release the firing pins by means of electrical devices called *ELECTRIC TRIGGERS.*

• Ammunition for the guns—enough to carry you through any mission if you don't waste it—will ride in cans mounted so that the belt runs smoothly into the feedways. Often *BOOSTER MOTORS* will help lift the belt to the guns. And often the

empty cases will drop through special *EJECTION CHUTES* out of the turret or into *SPENT ROUND BAGS* attached to the ends of the chutes.

• As you swing the guns around, you won't have to worry about shooting at parts of your own bomber. Every turret where this danger exists has a system of *FIRE INTERRUPTION*, or *FIRE CUTOFF*, which stops the guns automatically when they are pointed toward any part of the bomber.

. . . the controls are in easy reach

. . . once you have developed the touch, the turret practically runs itself

• Nor will you have to worry about swinging the guns so far that they bang into your own ship. Turrets have *LIMIT STOPS* which prevent that. On some turrets the limit stops are simply bumpers; others, in addition, have automatic switches which halt the turret before any damage can be done.

• All the switches you need to operate the turret will be located within easy reach. The control handles will enable you to run the turret as easily as an automobile. Once you have developed the touch—the secret is to keep a steady hand, without jerking—you will be able to track the enemy smoothly and accurately.

• For whirling around quickly to meet a new attack, your turret will be able to get up to high speed. The distance you move the control handles will determine the speed—and in some turrets you will have a special high speed button which throws the turret into high gear to give you an extra boost. If your turret has a high speed button, use it only when you really need it—to avoid unnecessary wear and tear on the power system.

• If the turret power should ever fail, you will usually have a *MANUAL SYSTEM* for operating it by hand cranks. Some turrets even have foot pedals which enable you to fire the guns while using both hands to crank the turret into position. This is an important emergency protection; use it to keep your guns pointed at enemy fighters even though your fire cannot possibly be so accurate as when the power is on, for a motionless turret is an invitation for fighters to attack.

• Even if the guns are out of order, keep tracking the enemy; if you can't hit him, you may at least scare him away.

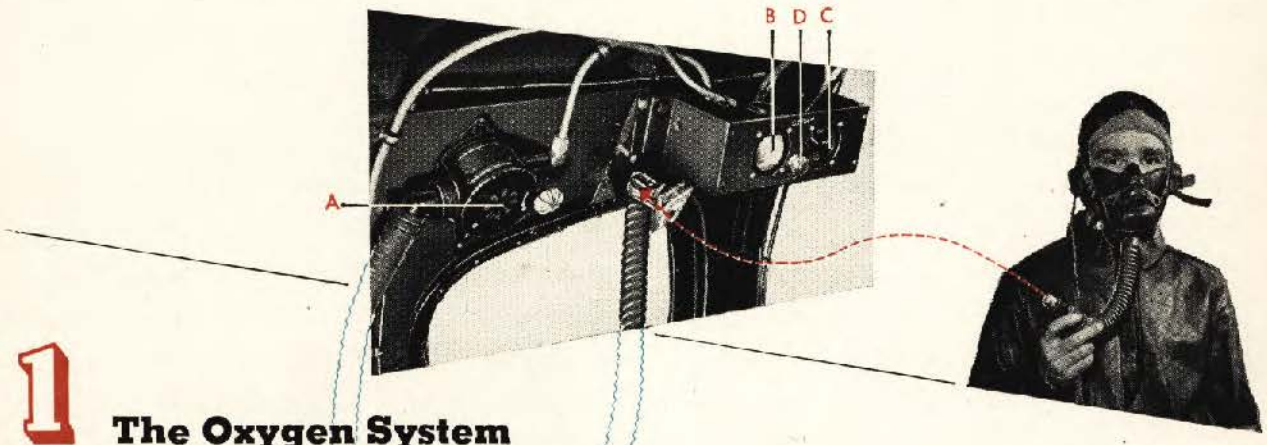
The Auxiliary Units

. . . all turrets have them
. . . they are designed for living five miles up

The manual system for operating the turret is one of the **auxiliary units,** which are like an automobile's accessories. Without the auxiliary units, the turret and guns would still operate, but the gunner himself would have a tough time of it.

For one thing, you can't go five miles up in the sky—which is where you will do most of your fighting—without special equipment for breathing in the thin air and keeping warm in temperatures that range down to 50 degrees below zero. Your turret has that equipment, as well as other auxiliary units for keeping in touch with other crew members, making emergency repairs in the dark, and taking training or combat films.

The manual system differs from turret to turret and will be discussed separately in the descriptions of individual turrets. But all other auxiliary units are basically alike, regardless of what turret you use.



1 The Oxygen System

Over 10,000 feet, the air gets so thin that a man's efficiency falls off rapidly; he can neither move nor think with any speed. At 25,000 feet, where heavy bombers usually fly, no man can stay conscious without extra oxygen.

Your oxygen supply, therefore, is your most important auxiliary unit. You will have a mask connected by a large flexible hose to a **regulator** (A) which adjusts the flow of oxygen to the amount required at various altitudes. In most turrets, the regulator will be the new **demand type,** which operates automatically and will always make sure that you get exactly the right amount, no more and no less.

There will also be a **flow and pressure gage** (B, C) which shows whether oxygen is flowing and how the supply is holding up. If the pressure goes down to 100 pounds—the danger level—a warning light (D) will flash on.

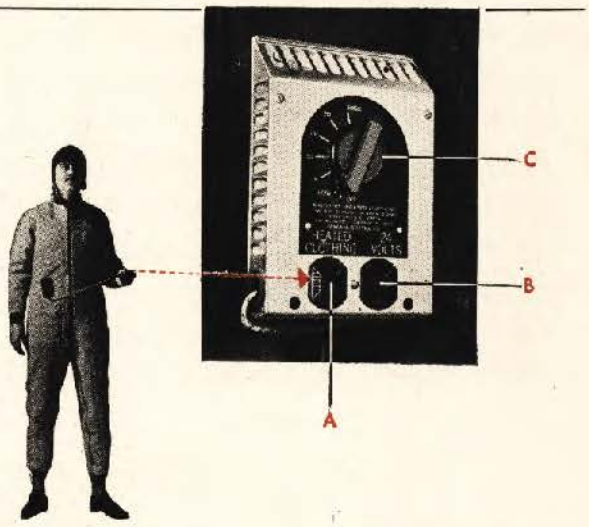
The source of oxygen supply will depend on the turret. In most turrets, the oxygen comes directly by tubing from the bomber's central tanks. In some, you will have one or two bottles which contain enough oxygen for about one and one half hours, and can then be refilled from the central supply.

Before each mission, check all the connections on the oxygen system, particularly swivel joints,

to make sure they are tight. Check the hose to make sure there are no cracks or leaks. Then put on your oxygen mask, connect it, and make sure oxygen flows into it—take a look at the flow gage. Check the pressure to make sure it is up to the point required for the mission, as determined by your crew chief.

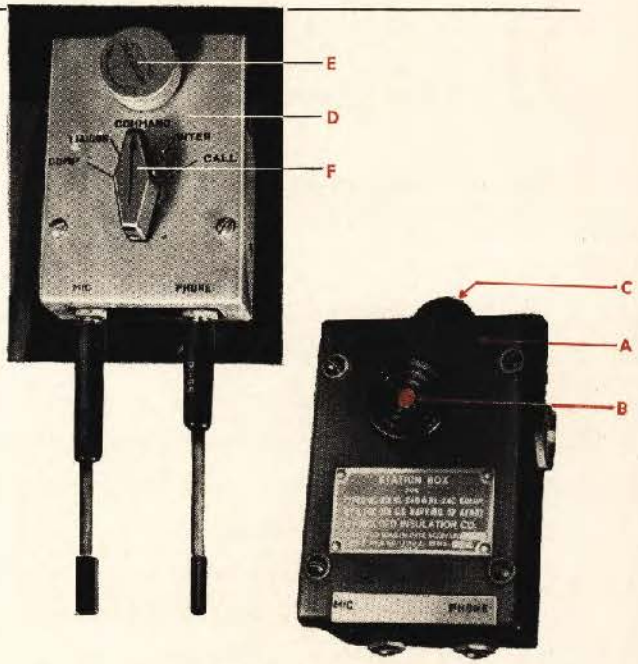
One important precaution: Never leave oil or cleaning fluid around the oxygen leads. Oil plus oxygen adds up to an explosion.

2 The Heated Suit



Your flying suit is like an electric heating pad. By adjusting the rheostat on the suit you can be comfortable at all times. In the Navy two types of plug-ins are provided. One, also used by the Army, consists of a box with two outlets, one marked **Heated suit** (A) and the other **24 Volts** (B). The rheostat (C) may be disregarded after turning it to "High," as the heat will be regulated by the rheostat built into the suit. The other type, used only by the Navy, consists of an ordinary electric outlet located on your control panel or some other convenient place. Before each mission, plug in your heating suit and make sure it is working. Test the rheostat in the suit by turning it from high to low to make sure the heat is controlled.

3 The Interphone



The inside of a bomber is noisy and the crew members are stationed far apart. To talk to your crewmates—to tell them what you see and to get their warnings of enemy fighters—you use the radio interphone system. You have a microphone—either a throat, oxygen mask or hand-held microphone — and earphones which plug into a jack box in or near your turret. This jack box will be of two types, selector or non-selector. The non-selector type jack box (A) is equipped with a push-to-talk button (B) and a volume control (C). In the latest turrets an additional push-to-talk button may be built into the control handles. The push-to-talk button for the selector type jack box (D) is located on or near the control han-

dles. The jack box itself is provided with a volume control button (E) and the selector switch (F) with five different positions:

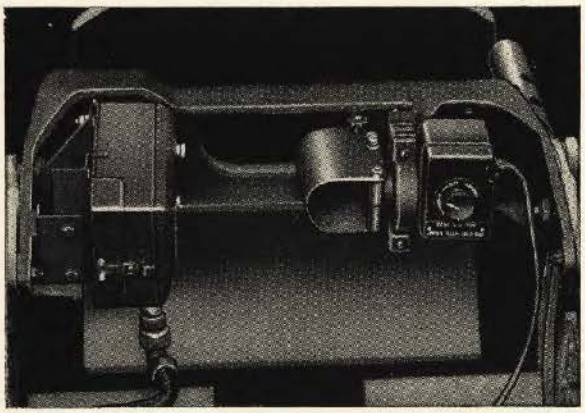
INTER—On this position you can hear and talk to all other crew members whose jack boxes are on INTER.

CALL—This position is used only when it is necessary to contact some crew member whose jack box switch is not on INTER.

COMP—When the switch is turned to this position you hear the radio compass receiver.

LIAISON—At this position you will hear the pilot's Very High Frequency command equipment, used for plane-to-plane communication.

COMMAND—At this position you will hear the pilot's Medium Frequency command equipment, generally used for plane-to-ground communications such as landing instructions. To speak over the interphone system you will have to hold down a push-to-talk button. You will hear your own voice as you speak. Release the button immediately after talking so that you can hear your crew mates again. Speak naturally. Don't shout—it blurs your voice. Turn the volume control knob on the jack box to adjust the volume of your earphones. At high altitudes interphone operation is seriously interfered with if more than one push-to-talk button on the plane is held down at the same time. Don't attempt to speak while someone else is speaking except in emergencies. Try out the interphone before every mission. Make sure you can hear your crew mates clearly, and that they can hear you.



4 The Gun Camera

For taking photographs in combat or training, you will have a small bracket, usually near the gun sight, on which a gun camera can be mounted. A switch on the control panel operates the camera. When the switch is on, the camera will expose film as long as you are pressing the gun triggers.

5 The Trouble Light

For working in the dark, you will have a small trouble light with a switch and usually about six feet of cord. The socket is adjustable to provide either a floodlight or spotlight. Test the trouble light before missions. Make sure it goes on when you turn the switch. Examine the cord for worn places, and make sure the light bulb is seated firmly in its socket.

The Turret Gunner's Job

The preceding pages have described, in general terms, the compact yet complicated equipment which you will use as a turret gunner. You will have to know where all this equipment is in your own turret, how to prepare it for flight and make sure it is working properly, and how to use it in combat.

You will not be expected to be an expert turret mechanic; if something goes wrong, trained maintenance men will repair it. But you will have to know enough about how the turret works to recognize trouble when it occurs, and to spot it before—not during—a mission.

Some of the checks you will make—on auxiliary units such as the oxygen system, interphone, and trouble light — have already been described.

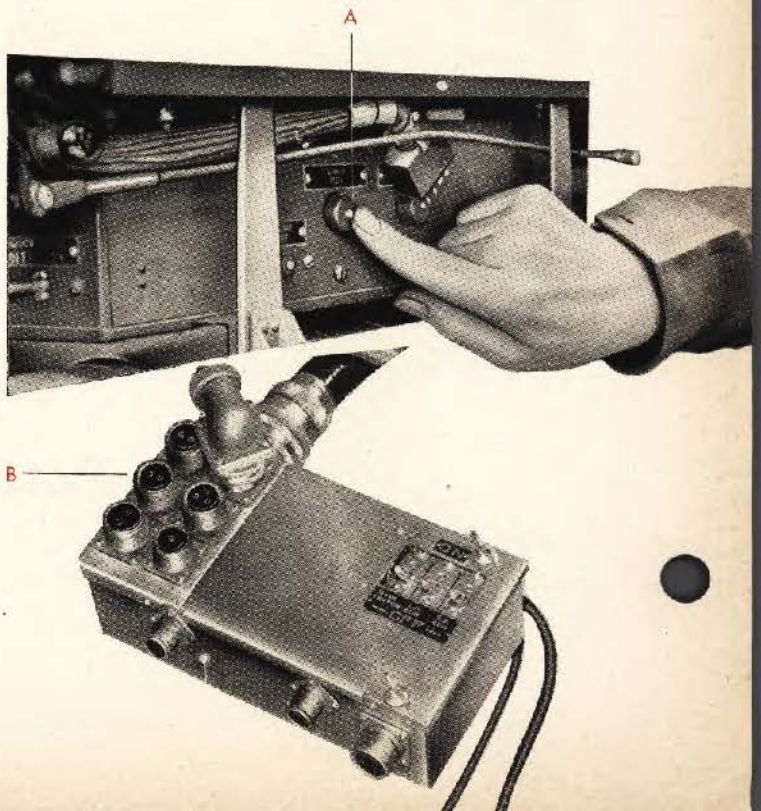
In the next few pages, you will become acquainted with the purpose, use, and care of such standard turret equipment as plexiglas domes, safety switches, reset buttons, clutches, cutoff systems, and many others. With the information contained in these pages, you will then be ready to start specializing on the turret to which you will be assigned.

Reset Buttons and Fuses

To protect the electrical circuits, most turrets have a set of either reset buttons (A) or fuses (B). The fuses operate just like those in a house; they blow out when a circuit gets overloaded or shorted and must then be replaced. The fuses are plugged in the turret's main switch panel; spares are usually carried in clips nearby or in a spare parts box.

Reset buttons, which are usually found on the control panels, do the same job in a little different way. When anything goes wrong with a circuit, its reset button pops out and cuts off the current. To make the circuit work again, you must push the button back in.

A combat tip on reset buttons: Sometimes, if you have been operating the turret at high speed, the electrical circuits which drive the turret will become so over-heated that the reset buttons will pop out as soon as you push them back in. If you are in the midst of an attack and must keep the turret working at all costs, hold the reset button in with one hand and operate the turret controls with the other. Do this only in real emergencies: You will overwork the circuits so badly that you will probably burn out motors or other equipment.

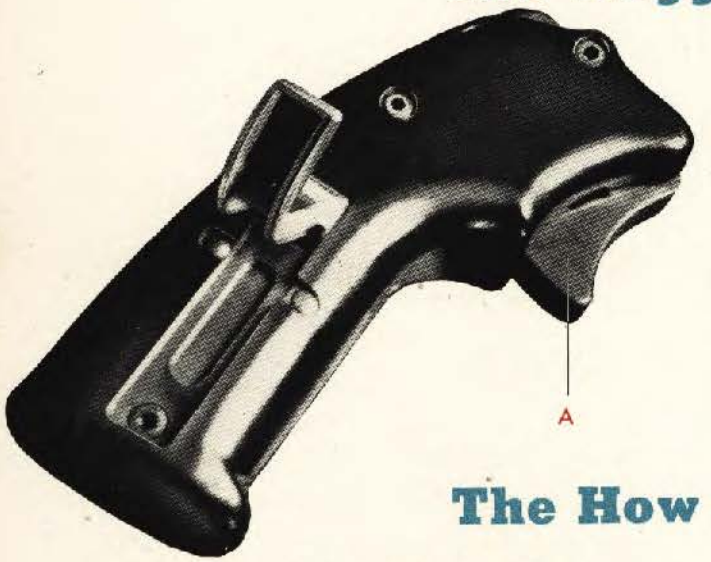


The Safety Switches

are built into the control handles. One type is set into the handle and is closed by squeezing it. The other and more standard type (A) is built out from the handle, like a wing, and is closed when you grasp the handle and press down the edge of your hand on the switch. Both have the same safety feature; the turret won't move unless one switch is closed.

Test the switches by pressing one at a time. The turret should respond. Then release the switch. It should spring back into open position immediately, and the turret should stop cold. Try the switches several times. Always close them quickly to avoid burning them out.

The Trigger Switches



are always located right on the control handles (A), usually under your index fingers. To test them, first make sure there is no ammunition in the guns. Then press the triggers. A sharp click in the electric trigger control will tell you if the firing circuit is working properly. Usually both guns are hooked up to fire from either trigger—press one trigger at a time and make sure both guns click.

The How and Why of Clutches

Clutches are provided on almost all turrets to allow you to disconnect the azimuth and elevation power gearing. Without this heavy gearing to move, it is easier to push the turret around by hand in making repairs and easier to run the turret manually in emergencies.

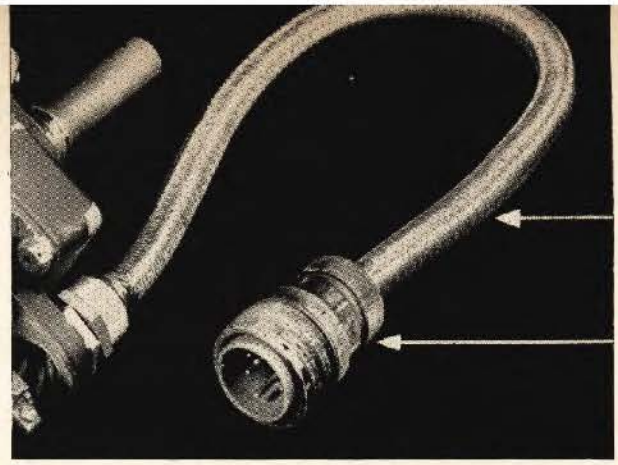
The clutches are in different places in different turrets. Most of them are simply levers, which you push back and forth into the engaged or disengaged position. You can then make a final check by trying to push the turret around by hand and trying to move the guns up and down. If you have a hard time moving the turret, the clutches are properly engaged.

Never take off or attempt to run the turret under power without first making sure that the clutches are engaged. It's like trying to drive your car with the clutch down to the floor. The mechanism is out of control. The turret will swing freely up, down, and around in the slipstream in a way that is dangerous to the navigation of the plane and may even cause a crackup. The sight cradle swinging around dizzily inside may crack your head. For the protection of others, always leave the clutches engaged when you leave the plane.

Leads Breezes Cannon Plugs

. . . they carry your current

. . . make sure the connections are always tight

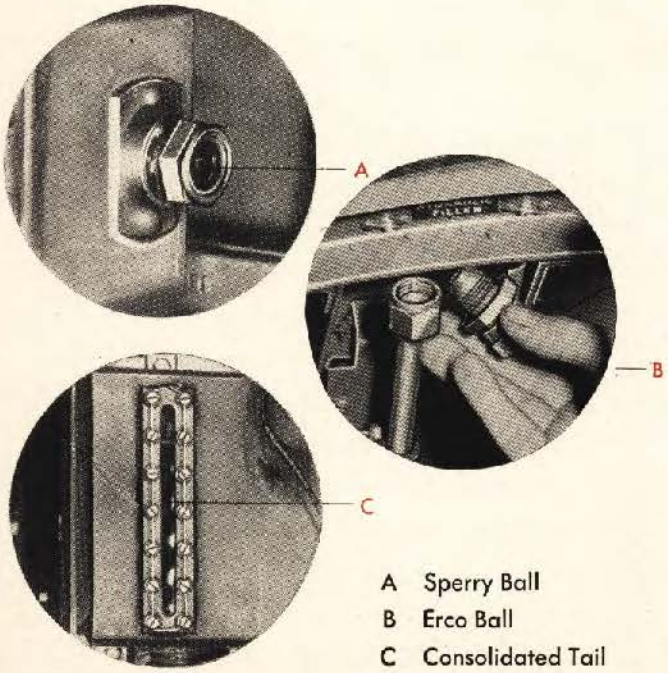


In all turrets the current is distributed through electric leads usually covered with flexible metal conduits commonly called Breezes (A). These Breezes are important; if they are frayed or pulled out at the ends, the circuits won't work. Connections between Breezes are made by Cannon plugs (B)—plug-ins with a threaded ring and sleeve to hold them together. Before each mission, examine the Breezes closely. Watch out for frayed or worn Breezes and pay special attention to where they are attached to the Cannon plugs. Check the Cannon plugs to make sure they are plugged in and screwed up tightly.

Testing the Limit Stops

They prevent your guns from banging into the fuselage and must be tested before each mission. Run your guns into the fuselage, wherever they could possibly strike when moving up, down, or sideways. Take it easy, to avoid damage if the limit stops are not working properly. Unless the stops halt your turret before the guns hit the fuselage, report them.

Checking Hydraulic Systems

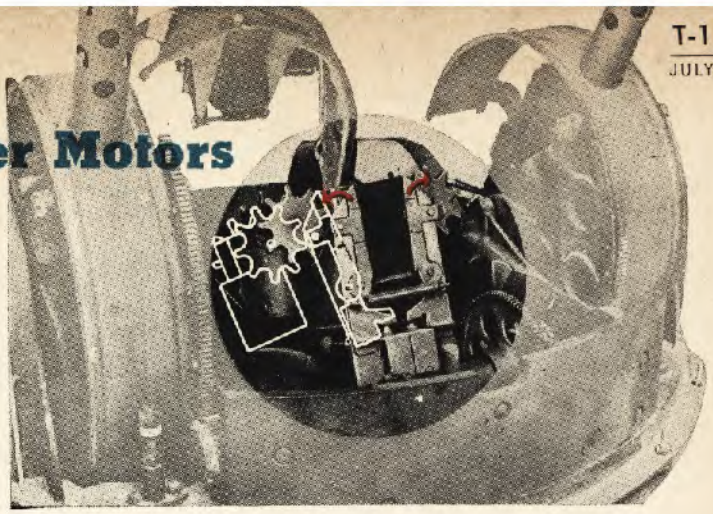


A Sperry Ball
B Erco Ball
C Consolidated Tail

In all turrets which operate hydraulically, the hydraulic systems must be filled with oil to the correct level to work properly. You will find a gage with a mark or screen to show the correct level. Check the gage every day. If the gage does not read FULL, report it.

Make a habit of inspecting the hydraulic system and lines carefully for leaks. This is best done with someone operating the turret to keep pressure in the lines, while you go over the system with a flashlight. Examine the line tubing for cracks. Take particular note of swivel joints and tubing connections. If your turret has hydraulic gun chargers, make a careful check of their parts and lines, too. Report all leaks to turret maintenance.

Use and Care of Booster Motors



The booster motors found in most turrets, to help lift the ammunition belts into the guns, always operate automatically. The motor, which turns a sprocket wheel on which the ammunition belt rides, is pulled toward the gun when the gun is fired; this automatically turns on the booster motor switch. When the gun stops firing, the pressure on the ammunition belt stops and springs pull the motor back to its normal position; and the switch cuts off.

Test your booster motors before every mission, before you have loaded ammunition over the sprockets. Tilt the motors toward the guns. See if they start immediately and run smoothly. Then release the motors. Make sure their springs pull them back to normal position and the motors stop at once. But be careful around these motors: They are powerful, and their sprocket wheels can cut off a man's finger.

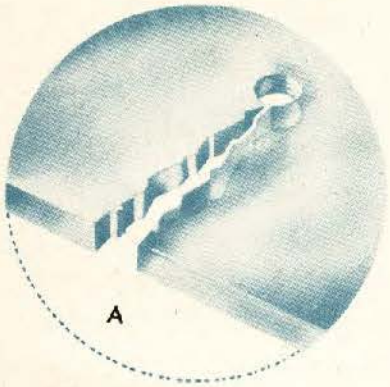
Occasionally vibration during combat causes the automatic switches to lock; in that case the booster motors keep turning and the ammunition belts are piled up against the guns, preventing the guns from firing. If this ever happens in your turret, disconnect the electric cables which lead to the motors. Your ammunition belts may not feed so smoothly, but at least you will get your guns back to work.

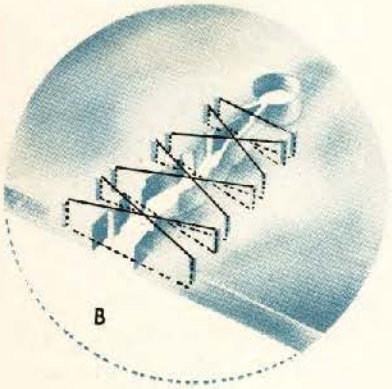
Testing the Fire Cutoffs

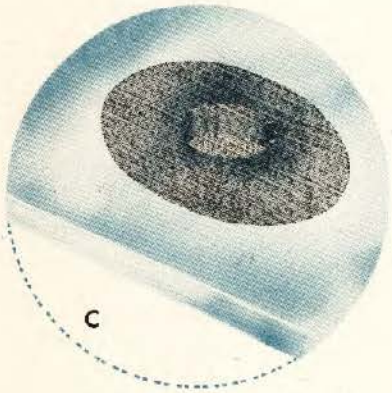
Fire interrupter systems are so complicated that adjustments are always handled by turret maintenance, but you are responsible for testing the interrupter before missions to make sure it is working. Test with the guns unloaded. Detach the Cannon plug from the electric trigger control and insert a test light in its place. Squeeze the trigger and swing the turret guns across the portions of the plane into which the guns could fire. The test light should go out just before the guns come to bear on any portion of the plane. This indicates the interrupter has gone into action. With a boresighting tool check the distance from the point where the light goes out to the structure of the plane into which the guns could fire. Repeat this procedure for each gun and each danger area bringing the guns to bear first from one side and then the other. Then do the same thing while moving the guns in elevation bringing them first down on the danger areas and then up. Each gun should cut off with an ample clearance on the danger areas. The amount of clearance should be about equal above and below the danger areas and to either side. If the guns fail to cut off, if the clearance is too small or if the clearance is not the same in all directions, report it at once. It is not wise to put complete confidence in the fire interrupter particularly after you have been firing long bursts because it is possible that a round may "cook" off in the gun even though you do not press the triggers.

The Dome

. . . it serves as your windshield
. . . keep it clean and in good repair







All turrets have plexiglas domes or panels to protect you from the slipstream and still give you a clear view of the sky around you. Plexiglas is a glass-like plastic. It scratches easily; and the first rule is to be careful with it.

Clean plexiglas with plenty of soap and water. Never use a dry cloth—it may scratch, and it will build up static electricity that attracts dust. Never use hot water because heat softens the plastic. You may use a little plain kerosene or naphtha to remove grease or oil, but beware of all cleaning sprays or solutions. They usually contain chemicals which soften and crack the plexiglas.

Only qualified maintenance men should repair major scratches, cracks, or holes in plexiglas. But sometimes you may have to make temporary repairs.

Rub out minor scratches with automobile or furniture wax, always using a circular motion in rubbing. This gives a good gloss and helps prevent future scratching. In fact, an excellent scratch preventative is a good simonizing job on the whole dome.

At the first sign of a crack in plexiglas, notify maintenance. If cracks aren't caught soon enough, they rapidly grow into major breaks under further strain and the ripping force of the slipstream. If you have to make a temporary repair yourself, first drill a hole about 1/8 to 3/16 inch in diameter in the end of the crack (A); this will distribute the strain over a wider area. Then drill a series of small holes on each side of the crack, about a half inch away, and lace the two edges together with wire (B). This will prevent the crack from spreading.

If you have to make a temporary repair on bullet holes in plexiglas, use a half-round file to trim the hole and any cracks surrounding it to a circle. Then put on a round patch of wing fabric or thin plexiglas or cellulose acetate sheeting (C), using "dope" or other solvent on both surfaces to make them stick. Mask the area around the hole so that the "dope" or solvent, which softens and cracks the plexiglas, can't spread. If you have no patching materials handy, whittle out a wooden plug for the hole until you can have permanent repairs made.

How to recognize "Creep"

. . . it is a common turret ailment which requires immediate repairs

When your turret is suffering from "creep"—a fairly common turret ailment—it is in no shape to go into combat.

Watch for creep when you test operation of the turret before each mission. It is easy to recognize. When the control handles are held neutral the turret, instead of stopping, continues to creep a little farther in one direction or another. If you try to use the turret in combat, every time you try to train your guns on the target the turret will go a little beyond, so that you will always miss your mark.

Report even the slightest amount of creep immediately. At the same time, watch for "binding". Make sure the turret does not stick or drag.

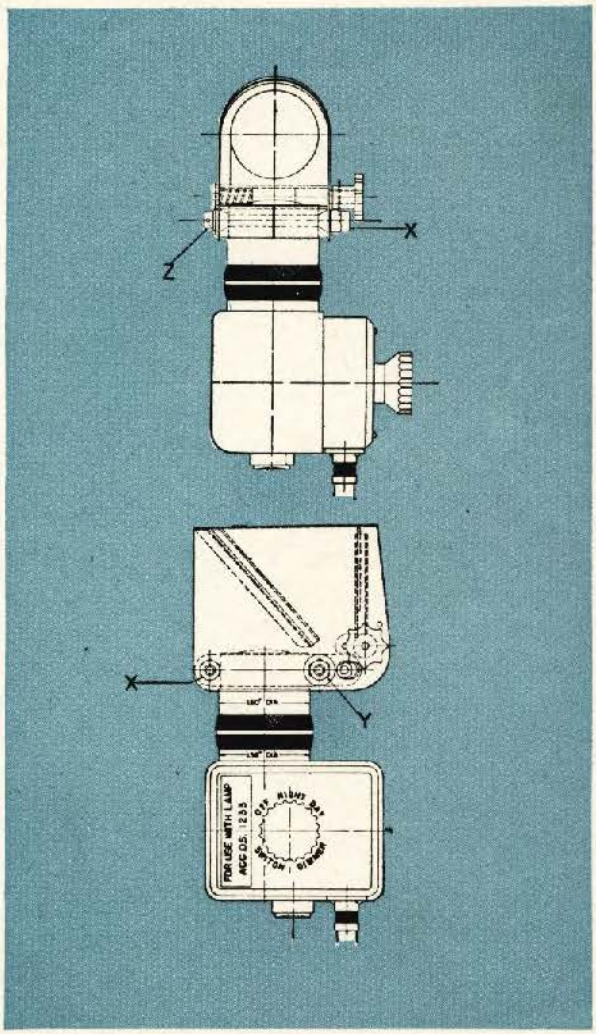
The MK 9 Reflector Sight

Most Navy turrets are equipped with a MK 9 Reflector Sight mounted directly in front of you at eye level. This sight is a sturdy mechanism, but it will not stand being used for a hand grip when you climb into the turret. Normally in harmonization you will adjust the turret guns to the sight, but sometimes there may not be enough adjustment in the gun mounts to do this. If this is the case, it will be necessary to make adjustments on the sight head, to line up the sight with the guns.

Elevation adjustment is obtained by loosening the nut (Y) on the side of the sight and turning the boresighting cam (Z).

Azimuth adjustment is obtained by loosening the adjustment nut (X) on the side of the sight and rotating the hood in azimuth until the desired adjustment is reached.

Before a mission, test the sight bulb, making sure both filaments are good. If either is burned out, replace the bulb. Check the rheostat for operation by turning it from dim to bright. Clean the reflector plate of the sight.



The Turret Guns

A machine gun is always a machine gun, whether in a turret or on the ground. It requires the same care, the same adjustments, the same field stripping and detail stripping to enable you to clean it, oil it, and inspect it before and after every mission. The pre- and post-flight checks described in the Guns section must be followed to the letter.

The special equipment which makes the caliber .50 easy to use in the crowded space of the turret will be installed for you by turret maintenance, and you will never have to remove it. You will leave the gun casing group mounted in the turrets, and will not install, remove, or adjust the special charging unit or the ejection chutes provided in some turrets to carry away used links and brass. You will simply take off the backplate and then pull out the "guts" of the gun—the bolt, oil buffer, and barrel groups—to clean, inspect, and oil them. But you will have to know from which side the guns feed, so that you can reassemble the bolts properly. And you will have to know how to install and adjust your electric triggers and how to check the charging units to make sure they are working properly.

1 Assembling the Guns

In all turrets, one gun must be assembled for left-hand feed and the other for right-hand feed. Use the standard procedure for changing the direction of feed as described in the Guns section of this manual.

In some turrets, the two guns are installed to feed from the inside—with the right-hand feed gun at your left and the left-hand feed gun at your right. In other turrets, the guns feed from the outside.

2 Electric Trigger Controls

The guns in your turret are fired by electric trigger controls (gun firing solenoids) which are mounted either on the buffer tube or on the side plate of the gun. Of the various types of electric trigger controls found in Navy turrets the MK 7 Mod 1 is the most common. It is mounted on the buffer tube. When you squeeze the trigger in the control handles an electric magnet in the electric trigger moves a plunger which trips the trigger bar, firing the gun.

Other trigger controls such as the MK 5 Mod 1 or the MK 4 Mod 1 are mounted on the side of the gun. The plunger in these types cams the sear slide which disengages the sear from the firing pin assembly and the gun fires. All electric trigger controls are adjusted in a similar manner. The procedure for adjusting the MK 7 Mod 1 which follows will serve as a guide for the adjustment of other electric trigger controls found in turrets.

3 Adjusting the Electric Trigger Controls

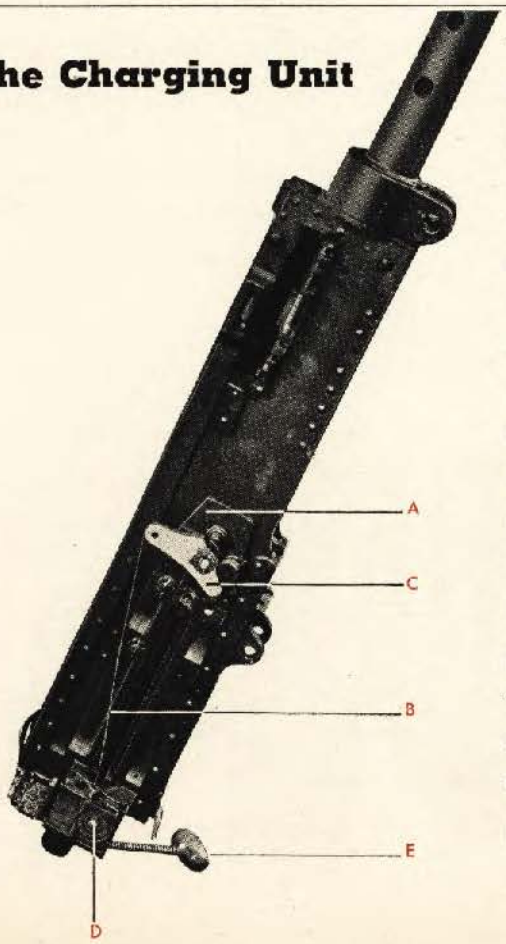
Be sure the headspace adjustment is correct as shown in the section on machine guns. Make sure the firing circuit is on. Then follow this procedure for adjusting each electric trigger:

A Turn the adjusting cap to the right, *clockwise*, until it stops.

B Turn the cap to the left, counterclockwise, one notch at a time, charging and attempting to fire the gun each time, until you reach a notch where the firing pin releases each time the gun is charged. Test it at this point two or three times. Then turn the cap another three notches counterclockwise.

C Check the adjustment at this point with a standard fire and no-fire timing gage. Place the .020-inch gage (FIRE) between the trunnion block and barrel extension, charge and fire the gun, and make sure the firing pin releases. Then use the .116-inch gage (NO FIRE) and make sure the firing pin does not release.

4 The Charging Unit



Most charging units operate mechanically, by a pulley-and-cable arrangement. Some work hydraulically. But the purpose of all charging units is the same—to enable you to charge your guns easily in the crowded space of the turret. On mechanical units, you will simply pull two cables, one for each gun. On hydraulic units, you will press a button which charges the guns automatically.

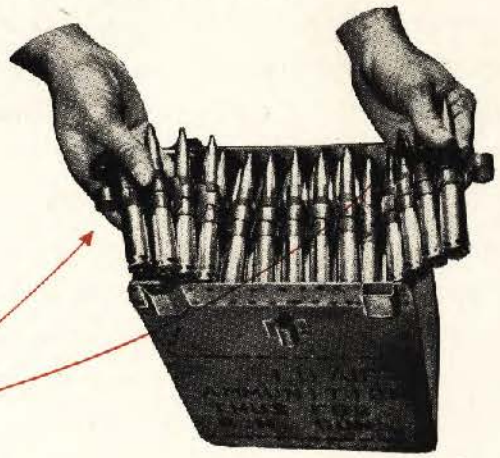
Before every mission test your charging units—without ammunition in the gun—until you are satisfied they are working properly. If you have a mechanical unit, make sure the charger plate (A) is properly bolted and safety wired to the gun's receiver. Make sure the cables (B) are attached properly to their levers (C), are free from kinks, and ride smoothly in their pulleys (D) when you pull on the charger han-

dles (E). If your turret uses a hydraulic charger, watch for leaks as you test the charging action. In loading ammunition into your guns before the takeoff, you will simply push the first round of the ammunition belt into the feedway. The gun will then have to be charged twice, after you are in the air, to make sure that the first round enters the chamber and is ready to fire. Your flight commander will signal when to charge the guns.

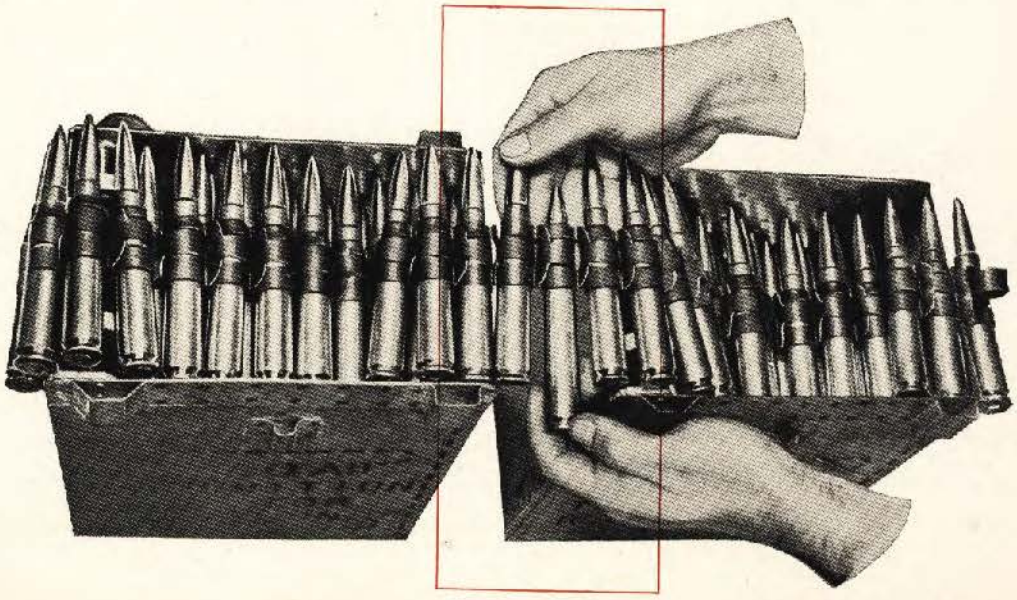
5 Loading Ammunition

In all turrets, ammunition must be carefully inspected before it is loaded into the plane or turret cans. Lay the belts out flat in some dry place where they will not pick up grit, dirt, or moisture. Watch for bad rounds and inspect for proper belting. Make sure that all rounds are pressed evenly into the links in line with one another. If the belting is irregular, it may jam your gun just when you need it most.

This is the standard method of folding the belt into the ammunition can, regardless of the shape or size. Note the pattern in which the rounds lie in the can. All cans are loaded starting with the single-link end of the belt first, so that the final topfold ends with the double-link end of the belt. The double-link end must always feed toward the gun. This can is loaded for a gun with right-hand feed. For left-hand feed, the double-link end must feed from the other side of the can.



To connect one ammunition belt to another, use this method. Use a single cartridge as a connecting pin to join the double-link end of one belt to the single-link end of another. Make sure the connecting round is pressed into the link all the way, in line with both belts.



Pre-Flight and Post-Flight Checks

. . . in all turrets, they are your life insurance

No matter what turret you use, your most important job as a turret operator will be making pre-flight and post-flight checks. You will check lists at the end of each individual turret section in the following pages, showing step by step every procedure you must follow from inspection before the flight, through the mission to the post-flight check after you return.

The pre-flight is particularly important, for it is the final, crucial examination of your turret—including all the specific checks already discussed—to make sure it is ready for battle. Unless you make these checks with great care, never omitting a single step, you cannot expect your turret to stay in working order. And if your turret ever fails in a pinch, you are out of luck.

A caution on pre-flight checks: You will have to run the turret on the bomber's auxiliary power, which means that you will be drawing on the same batteries that the plane depends on for takeoffs. Always have your crew chief supply the power; never use it without the crew chief's knowledge. Never operate the turret on the batteries alone.

At the end of each pre-flight, which naturally is different for each turret, you must make a general visual check. This is the same for all turrets. Run your eyes slowly over everything inside the turret. Then get out and do the same from the outside. Watch for such things as cracks or damage in the turret castings, loose covers on junction boxes, loose or missing nuts and bolts, nuts not safely wired properly, and so forth. Don't be afraid to report anything that seems to be wrong, however small it may appear.

These checks are often the difference between life and death. They are double indemnity insurance on the lives of your entire crew. Don't skip anything. Make them the most careful and serious jobs of your Navy career.

How to Use the Rest of this Manual

. . . it will describe each turret individually

Up to now, this manual has discussed only the features common to all turrets; the instructions up to this point apply to all turrets in use by the Navy today.

In the following pages, you will find individual descriptions of each turret, with special instructions for its use, care, and inspection. Described in the manual are eleven turrets, in this order:

GRUMMAN BALL	GRUMMAN 150SE-1 & 2
ERCO TEAR DROP	ERCO 250TH-1 & 2
ERCO BALL	ERCO 250SH-2, 2A & 3
MARTIN BALL	MARTIN 250SH-1A & 2
MARTIN ELECTRIC UPPER DECK	MARTIN 250CE-7 THROUGH 21
MARTIN HYDRAULIC UPPER DECK	MARTIN 250CH-1 & 3
MARTIN HYDRAULIC TAIL	MARTIN 250CH-2
CONSOLIDATED TAIL	CONSAIR 250CH-3, MPC 250CH-6
SPERRY RETRACTABLE BALL	SPERRY 250SH-1
BENDIX UPPER DECK	BENDIX 250CE-3 & 4
EMERSON BOW	EMERSON 250CE-1

★The official Navy name for turrets gives you a complete story on who designed the turret, the number of guns, the shape, the type of power and the model airplane for which it was designed. In other words, Martin 250CH-1 means Martin was the designer, 250 is two cal. 50 machine guns, C stands for cylindrical in shape, H for powered hydraulically and -1 indicates the model airplane the turret was built for. Other shapes are T for teardrop, S for spherical and R for remote control.

As a combat crew member, you will probably specialize in only one turret. But you will have to have a working knowledge of the other turrets in your plane, so that you can take over whenever necessary. You will find that knowledge in the following pages, and in your classroom instructions. As far as possible, this manual has been stripped down to the practical, working information that the gunner needs under everyday conditions. For each turret, the order of presentation will be as follows:

1 HOW TO GET IN
(This is not so easy as it sounds. In some turrets a man can be seriously injured if he tries to enter without knowing exactly how.)

2 HOW TO OPERATE THE TURRET
(Where to find the switches, and how to turn them on.)

3 WHERE TO FIND THE AUXILIARY UNITS

4 HOW TO GET OUT
(By this time, you will have a practical working knowledge of the turret and how to use it in combat. The rest of the instructions will show you how to prepare the turret for a mission.)

5 HOW TO ADJUST THE SIGHT

6 HOW TO ADJUST THE GUNS

7 HOW TO HARMONIZE GUNS AND SIGHT

8 HOW TO LOAD AND MOUNT THE AMMUNITION CANS

9 A CHECK LIST of the pre-flight and post-flight routine on each mission.

GRUMMAN BALL TURRET

GRUMMAN 150SE-1 & 2

The Grumman 150SE Turret, the only turret in the TBF Avenger, takes care of beam, overhead, or tail cone attacks on the airplane. In this turret, which is of the ball type, the gunner moves with the gun and sights in elevation and azimuth in the direction he turns the control handle. It is powered electrically and packs a mighty punch in its single cal. .50 machine gun.

The turret has been produced in two models—the Grumman 150SE-1 used in the Avenger 1 and the Grumman 150SE-2 used in the later model Avenger 2.

Facts and Figures

POWER

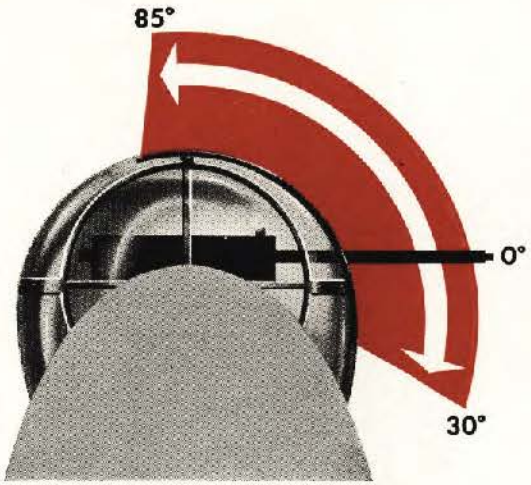
The Grumman 150SE Turret operates on power supplied from the airplane's central electric system.

SIGHTS

Its sight is a Navy standard Mk 9 reflector sight, fully described in the introduction of this section. The auxiliary sight is the Mk 11.

AZIMUTH

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



ELEVATION

In elevation the ball and gun can be raised 85° above horizontal and be depressed 30° below horizontal.

SPEEDS

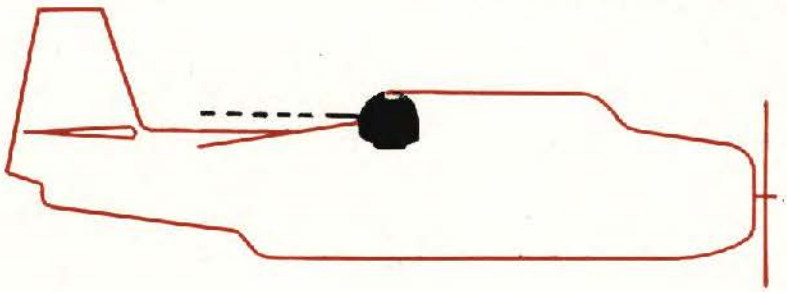
The turret has two speeds—normal tracking and high speed.

ARMOR

The armor plate protection in the turret consists of ½" thick armor plate in the front and sides; ¼" thick armor plate under the seat, and 1½" thick bullet-proof glass to protect the gunner's face.

STOWING POSITION

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



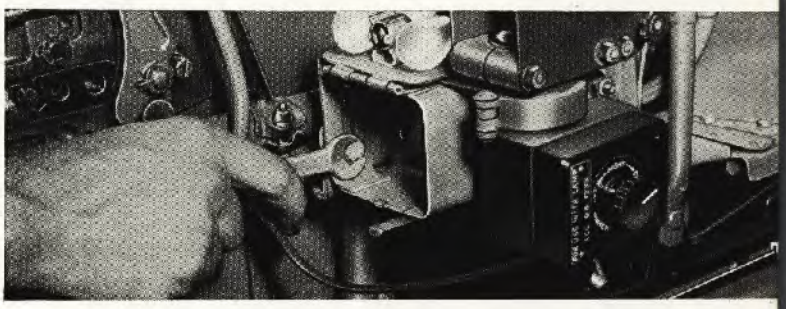
Getting In

Having been introduced to the turret in the Grumman Avenger, you will now want to know how to get into it. Pursue the following steps carefully, or damage to the turret might result.

Before entering the turret, make sure the **main battery switch** on the pilot's control switch panel is "on". Then check to determine if the **emergency switch** in the junction box is "on". This junction box is attached to the left bulkhead in the bombardier's compartment. To turn this switch off or on, it is necessary to remove the cover of the junction box.

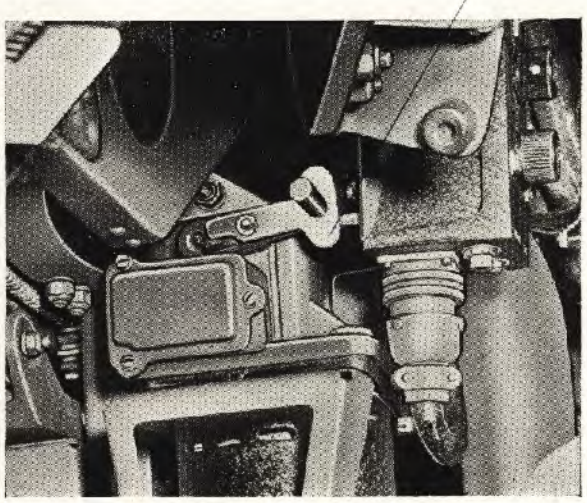
A flap of ¼" armor plate is hinged to the front of the turret's seat and stowed in the **up** position with a spring loaded pin. Pull out the stowing pin and swing the armor plate flap **down.** Facing forward enter the bottom of the turret. Reach up and grasp the side armor plate with your left hand. As you pull yourself up into the seat twist around so that you are facing aft. **Do not use the sight or the control handle as a hand grip.** Then place your feet on the front armor plate above the flange. Pull up armor plate flap, and lock it in **up** position with the stowing pin. **It is very important that this armor plate flap be stowed in the "up" position before you put the turret into operation. If left down, you can seriously damage the turret as well as the airplane.**

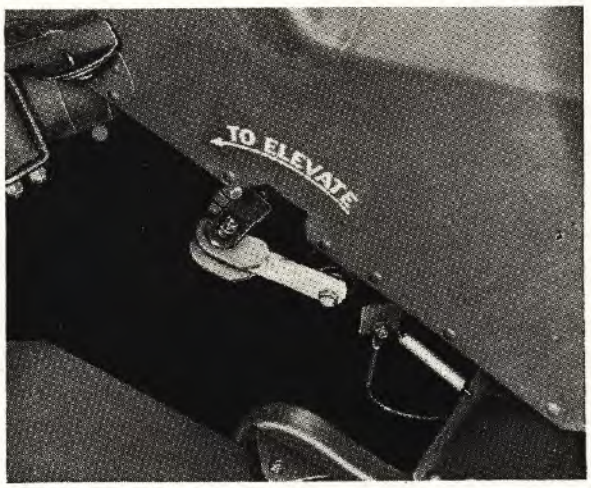
Look through the **sight** and determine if it is at the proper height. If the sight is not, loosen the adjusting bolts that hold the sight bracket and raise or lower it to adjust the height to your liking. Don't forget to secure the sight bracket adjustment bolts. Next to your left knee is the **elevation manual crank.** Check to see



that the crank is disengaged and that the handle is stowed in its retaining clip. Outside the ball on the right side under the right trunnion at track level is the **azimuth clutch.** Make sure that this is in the engaged **up** position.

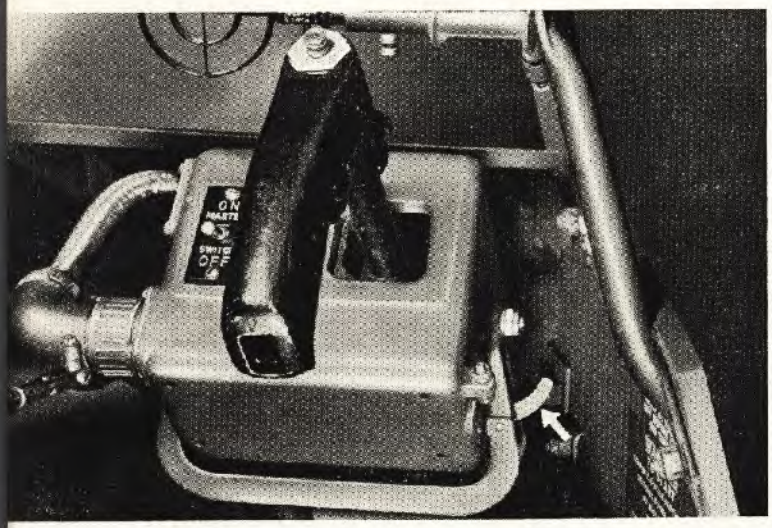
Fasten and adjust your safety belt—you will need it in this turret.

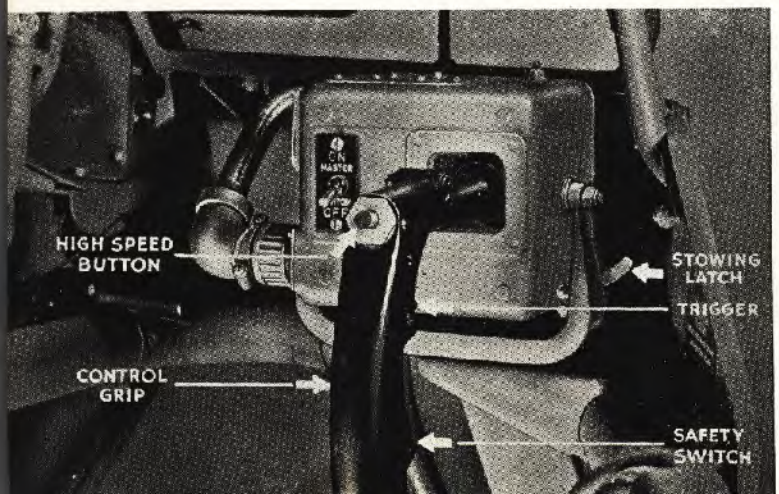




Operating the Turret

. . . Where to Find the Controls
. . . How to Use Them





Seated in the turret, you are now ready to begin to operate it. Directly in front of you and below the bullet-proof glass is the **control box** in which is installed the **pistol grip control handle,** and the **master switch.** This control box should be in the stowed position. On the right side is the **stowing lever.** Push down on it and the control box will drop into operating position. Make sure the lever is reengaged. Next to your left shoulder is the **control panel.** Reach over and flick on the **train** (azimuth) and **elevation switches.** Then turn on the master switch on the control box in front of you. The turret is now ready for instant action.

Remember at all times to keep your feet up on the front armor plate and your hands away from the moving parts while operating the turret.

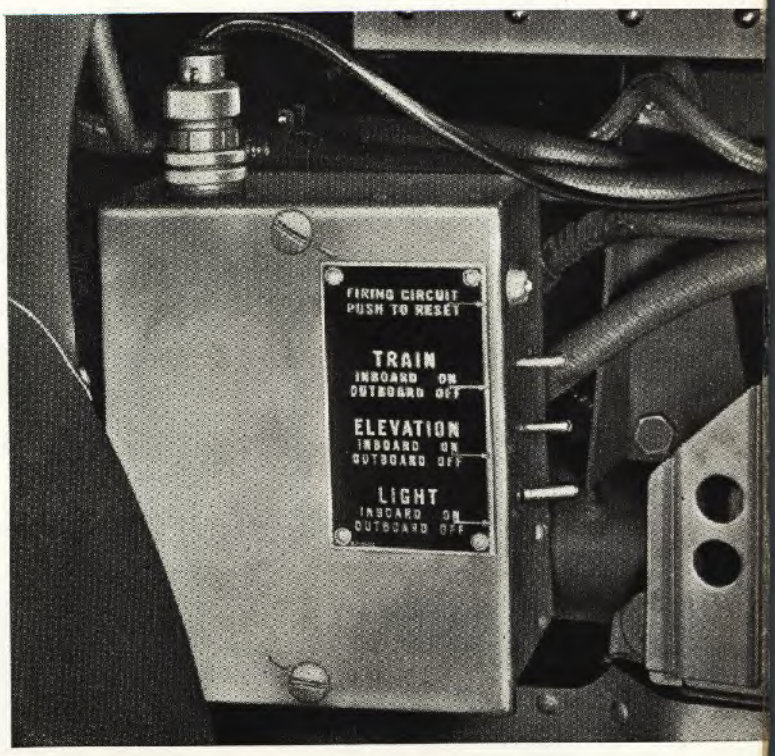
Grasp the pistol control handle, at the same time squeezing the safety switch in the handle to put the turret into operation. To move the turret operate the pistol grip control handle as you would a pistol. To roll the turret up, point the pistol grip up; to roll it down, point the grip down. The same is true for movement right or left.

The pistol control grip also contains a **high speed button** for increasing the speed of the turret for slewing from one extreme position to the other. Merely press the button on the back top of the grip with your thumb to bring this high speed control into operation.

Releasing the control grip will automatically return the gun to the trailing aft position and cut off power to the drive motors.

Right under your index finger in the pistol grip control handle is the **trigger** switch for firing the gun.

Charging the guns in the turret is a manual operation. In front of your left knee is the **charging handle.** Grasp the charging handle with both hands, one above the other, and give a hard pull all the way back. Then quickly release the handle and let it slide forward by itself. To hold the bolt back in the gun to facilitate boresighting and the removal of jams, a latch is provided to lock the gun charging handle in the back position.



Using the Auxiliary Units

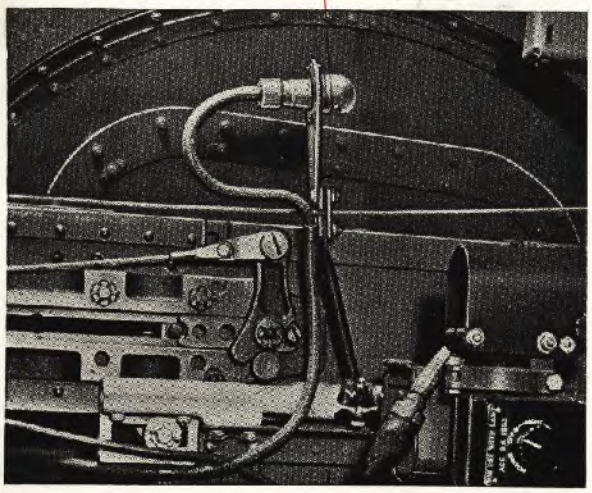
The **oxygen system** of the turret is dependent on the main oxygen system of the airplane. The oxygen is brought into the turret through the slip ring assembly at the bottom. Here is attached a flexible hose, which conducts the oxygen to the gunner's mask.

The **interphone jack box** located next to your right knee is where you plug in your inter-phone jacks for your headphones and throat microphone. This box is also provided with a volume control and a wave band selector switch.

In this turret no **heating suit outlet** is provided. However, in the bombardier's compartment directly beneath you, you can attach your heating suit to an outlet provided there.

A stationary **trouble light** located above the gun is installed in a bracket which is attached to the inboard side of the Bell Mount Adapter. The **light switch** is located on the control panel. As soon as the battery switch in the pilot's cockpit is turned on, you are able to turn on the trouble light in the turret and also the Mk 9 sight by means of its built-in switch.

Provisions are made for mounting a **gun camera** on the top left side of the bullet-proof glass face plate frame. To operate the camera depress the safety switch and trigger switch.



A built-in combination **elevation clutch** and **hand crank** is provided to permit manual operation of the turret without the power on. To put it to use, carefully unfold the handle halfway out, and rotate it until the clutch dogs engage; then completely unfold the handle and operate as desired. Never operate the elevation hand crank without being in the turret and then not below 0° elevation. This is because the gun and front armor plate are so heavy that the hand crank will whirl out of your hand, allowing the turret to roll down and damage the fuselage of the plane with the gun. If you are outside of the turret and wish to elevate or depress the gun with the elevation hand crank, have someone hold the gun.

An **azimuth clutch** is also provided for disengaging the azimuth drive so that the turret may be pushed around freely by hand. Both of these units will be of little or no use to you as a gunner, as they were mainly installed to help the maintenance men.

Getting Out

To get out of the turret be as careful as you were in getting in. Remove your hand from the pistol control handle, and the turret will return to the stowing position, 0° elevation and 180° azimuth—gun pointing straight aft. Push down the latch on the right hand side of the control box and raise the box up to its stowing position, allowing the latch to reengage, and secure the box in place. When stowing the control box, do not lift it by its pistol grip control but rather by the control box itself. Otherwise you can damage the internal mechanism of the box.

Turn off all switches and disconnect the auxiliary units you have been using.

Unfasten the safety belt.

Reach down and pull out the stowing pin which holds up the armor plate flap beneath you and push down the flap. Climb out of the turret facing aft, feet first, using the side armor plate as a hand grip to assist you in getting out.

Once outside the turret, push the armor plate flap **up** to its stowing position and lock it in place with its stowing pin.

Emergency Exit

If it is necessary for you to leave the turret in a hurry, an emergency exit is provided in the right hand side of the turret plexiglas enclosure. In the center of the hatch is a handle —grasp it and turn it **up**; then push out on the escape hatch and it will fall away leaving a hole big enough for you to get out. Another exit is to get down out of the turret and escape through a hatch on the side of the plane.

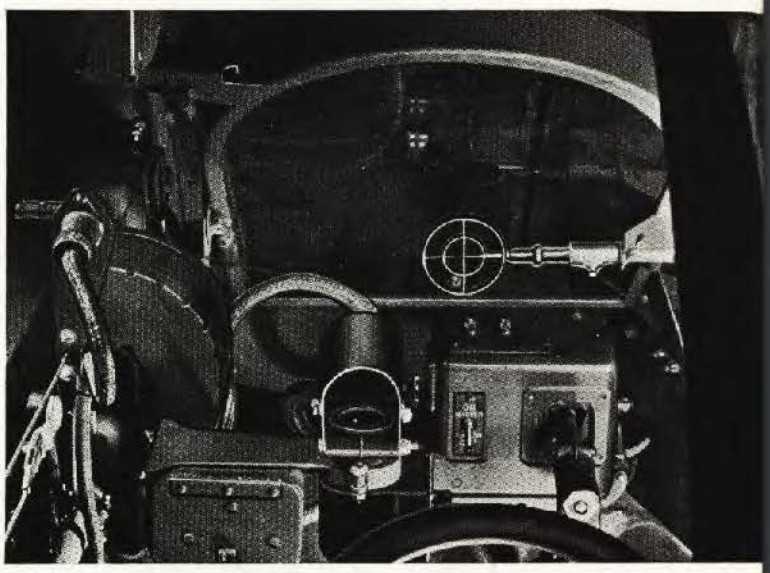
Preparing the Turret for Combat

You now have a good working knowledge of how to get in the turret, how to operate it, use its auxiliary units, and how to get out.

To complete your knowledge of the Grumman 150SE you have still to learn the rest of your duties, which consist of adjusting the gun and sights, harmonizing them, and loading ammunition. These will be taken up in the following pages.

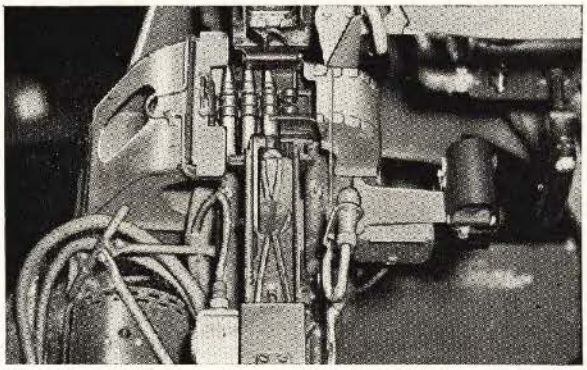
The Sights

Two sights are provided in the Grumman 150SE Turret—the standard Navy Mk 9 reflector sight and the Mk 11 iron ring and post sight. The Mk 9 reflector sight is the sight you will use, but if for any reason it should fail, you have the iron ring and post sight to fall back on. In adjusting the Mk 9 sight for harmonizing it with the gun, make all your adjustments on the sight head. For full instructions for making these adjustments, see the section on the Mk 9 sight in the general introduction on turrets.



Adjusting the Gun

The single cal. .50 gun of this turret is installed in a Bell Mount Adapter on which no provisions are made for boresighting adjustments. The gun is mounted to feed from the **left side.** This should be remembered when the gun is assembled in the turret.

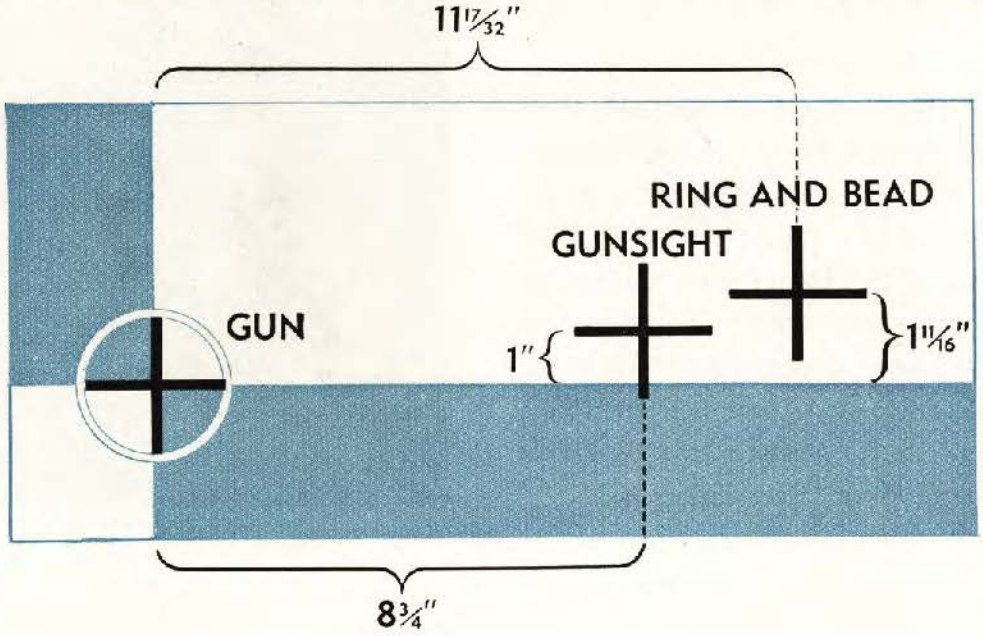


Harmonizing the Sights to the Gun

There is only one way to harmonize the gun and sights in a Grumman Turret. As there are no boresighting adjustments on the gun, it will be necessary to harmonize the sights to the gun. Set up the special pattern stand or template illustrated here, as level as possible 100 feet from the side of the airplane. Latch the gun charging handle in the back position and insert a breech boresighting tool into the gun. Operate the turret until the gun is lined up squarely in the center of the gun cross on the pattern stand. Turn off the master switch and hold the gun on the cross until the motors have stopped. The turret will remain there. Do not move the turret again.

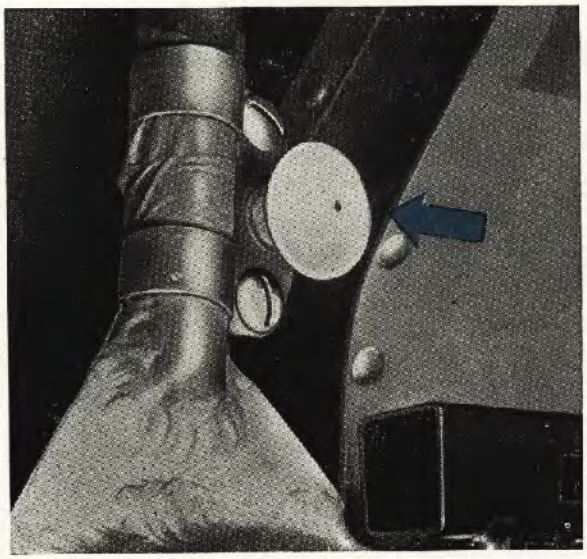
Now turn on the reflector sight switch, which is built into the sight, and make whatever adjustments are necessary on the sight head to line up the dot squarely on the reflector sight cross on the pattern stand. To complete the job line up the auxiliary ring and post sight on its respective cross on the pattern stand.

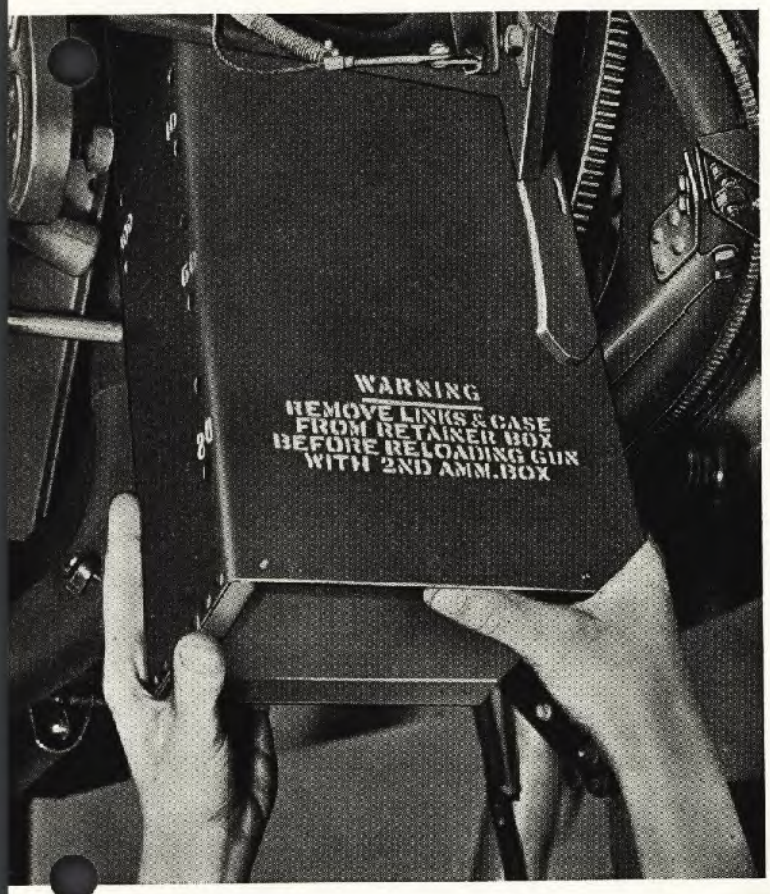
If your plane is land based, another method is to boresight the gun on some small object, such as a tree or chimney, at least 1000 yards away. Then adjust the sight head until the dot of the sight is squarely on the object. Both methods described here are parallel boresighting.



Loading Ammunition

The Grumman Turret is provided with one ammunition can which holds 200 rounds and is located directly under the gun. To remove the ammunition can, the turret is brought to the stowing position and the ammunition can is released by pulling the little **yellow knob** mounted right under the gun sight bracket. This knob operates a wire release which unlatches the can. In addition to this locking arrangement there is a cable lock which hooks on to the bottom of the ammunition can to prevent it from falling out in the event the yellow knob is accidentally pulled, or the mechanism holding the ammunition can in place fails.

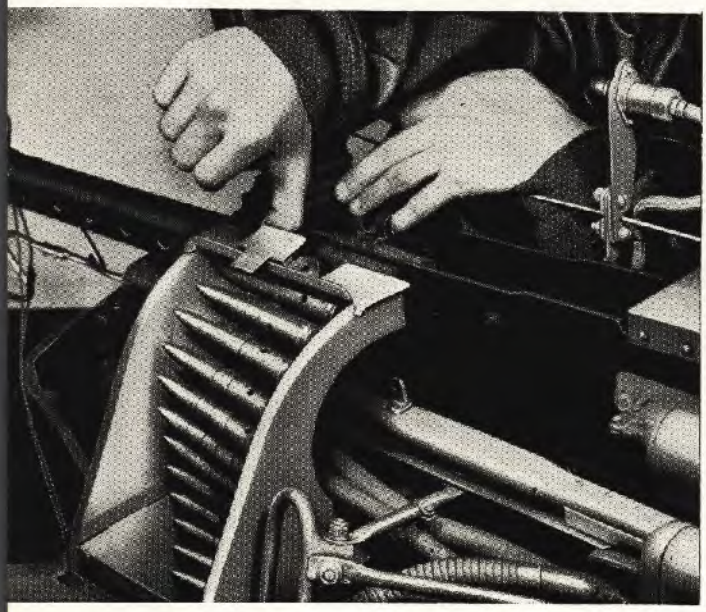


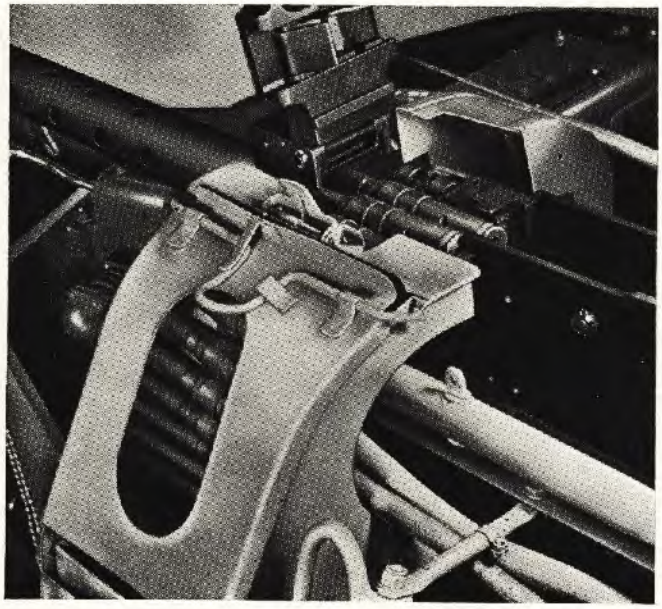


Installation of the ammunition can in the turret is done from the outside. Hold the can with the right hand on the bottom and the left hand near the top so that the guide rails on the can register with the guide track. Push upward until the can is approximately half way in the stowed position, and the can will latch itself. Now use both hands at the bottom of the can to push it home where it automatically locks in place. Hook the cable lock on the bottom of the ammunition container.

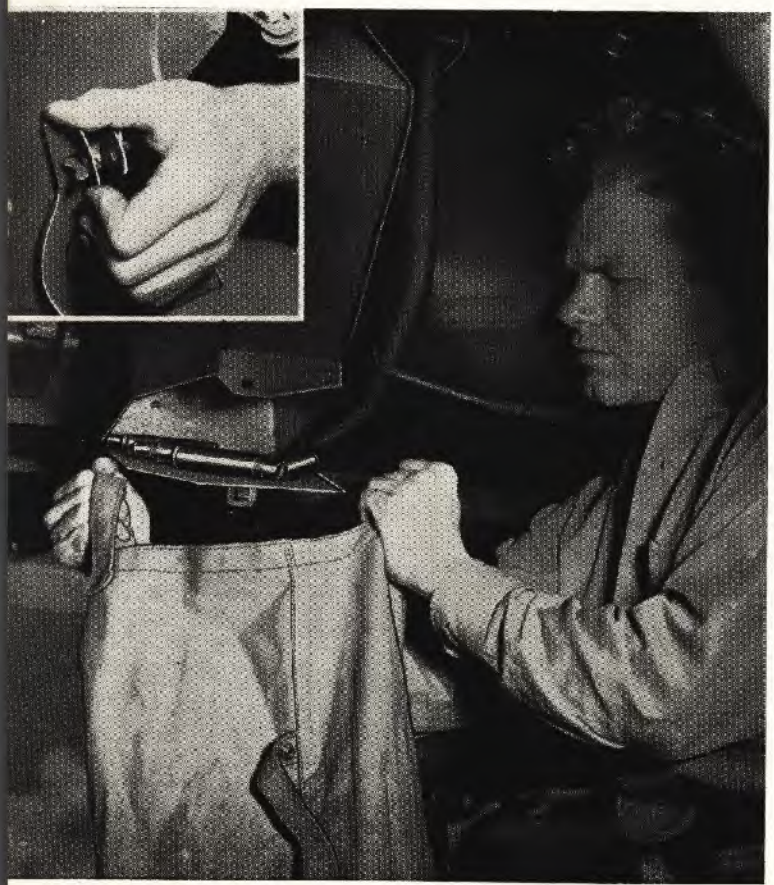
1. To load the gun, open the cover on the top of the gun.
2. Open the feed chute cover on the left hand side of the gun; slide your hand through the feed chute down into the ammunition can; pull up the ammunition belt and insert the first round through mouth of feed chute into the machine gun receiver. (The non-return ratchet prevents the belt from falling back into the feed chute.)

3. Pick up the extractor, pull back the charging handle approximately ¼", and pull up the belt until the first round is aligned against the cartridge stop. Drop the extractor between the first and second rounds. Slam the cover plate back into position.
4. Slam the feed chute cover to close position, and the job is complete.





Removal of Empty Cartridge Cases and Links



The empty links and cartridge cases are collected in a container almost directly under the gun. A lever secured with a winged Dzus fastener is mounted above the elevation hand crank to dump the container. Free the lever and push it down. Catch the empty links and cartridge cases in the special bag provided, or in some other container. Allow the ejection door on the bottom of the container to slam shut and resecure the lever with its winged Dzus fastener.

Always remember to empty the expended ammunition container when you load a new can of ammunition into the turret. This is very important because if the container becomes overfilled, the gun will jam.

Pre-flight Routine

. . FOLLOW STEP BY STEP

1. Completely reassemble the gun in the turret, making sure the gun is assembled properly to feed from the left.
2. Lock the bolt back by latching the gun charging handle in the aft position. Check harmonization of the gun and sights by boresighting on a pattern stand or some other object 1000 yards or more away.
3. Try to rock the gun in its mount. Make sure it is securely mounted. Check to see if the nuts are properly safetied.
4. Check to determine if the azimuth clutch is in the "up" position so that the turret cannot be pushed around by hand.
5. Check the elevation clutch and hand crank. Determine if it is not engaged and if the handle is stowed in the clip provided for it.
6. Hand charge the gun several times to test if it is working properly.
7. Inspect the flexible electric conduits (Breezes) to determine if they are frayed or broken.
8. Check all Cannon plugs to see that they are properly seated and screwed up tight.
9. Check the oxygen connections to make sure that they are tight.
10. Make sure the plexiglas dome, escape hatch, and bullet-proof glass face plate are clean and properly secured.
11. Check for ease of operation in elevation and azimuth. Depress high speed button and check the turret in slewing.
12. Remove your hands from the pistol control handle to determine if the turret returns to the stowing position. While in the stowing position check for turret "creep."
13. Operate the turret to extreme elevation to determine if the limit stops are functioning properly.
14. With guns completely depressed, carefully rotate the turret to determine if the contour follower keeps the gun from swinging into the fuselage.
15. With power on, safety switch depressed, squeeze the trigger and listen for the "click" of the electric trigger control.
16. Insert a test light in place of electric trigger control and with trigger depressed swing the turret across the portions of the ship into which the gun could fire. The test light will go out in this area. With a boresighting tool check the distance from the surface that the interrupter cuts out.
17. Turn on the sight switch and rotate the sight rheostat from dim to bright to adjust the brightness of the reticle to existing light conditions. Make sure the rheostat is working properly. Try both filaments of the sight bulb. If either is burned out, replace the bulb. Make sure the reflector plate of the sight is clean.
18. Open the spare light bulb stowing box on the sight bracket to determine if you have the required number of spares.

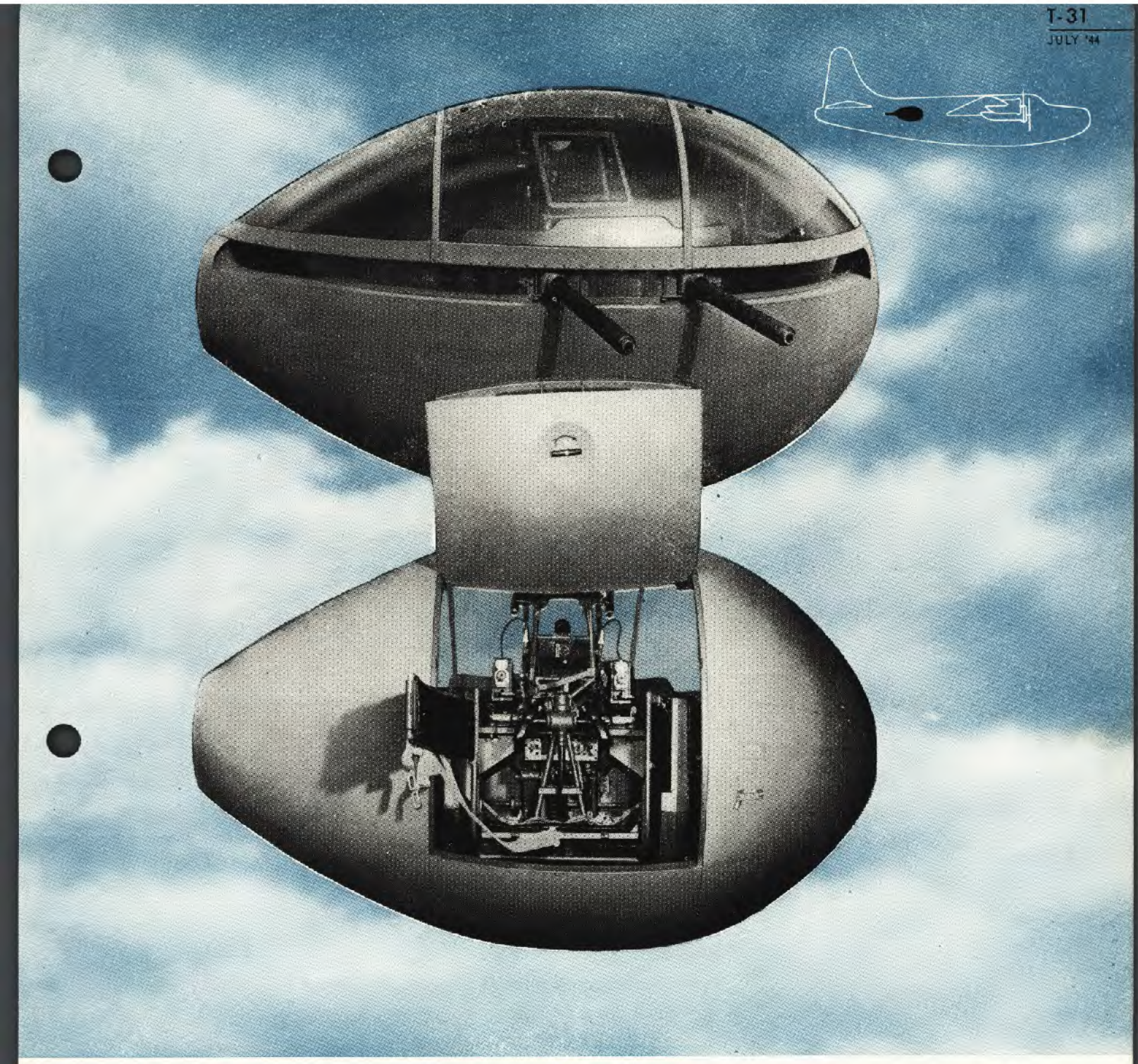
19. Plug your headphones and throat microphone into the inter-phone jack box to test if your crew mates can hear you and you can hear them.
20. Plug in your heating suit in the receptacle provided in the bombardier's compartment. Check to see if your suit heats.
21. Make sure the trouble light is operating.
22. Inspect all ammunition belts to determine that the rounds are in good condition and properly belted.
23. Make a complete visual check of the turret inside and out.
24. Load the ammunition can and install it in the turret. Feed the belt up through the feed chute into the feedway of the gun. You will not charge the gun until you are in the air and so ordered by the pilot.

Before Landing

1. Let go of the pistol grip control handle, and the turret will return to its stowing position—0° elevation and 180° azimuth, gun pointing straight aft.
2. Clear the gun by lifting the gun cover, removing the ammunition, and charging the gun twice.
3. Remove all ammunition from the feedway.
4. Check all switches and make sure they are off.
5. You will remain in the turret during landings.

After Landing

1. Disconnect any auxiliary units that you have been using.
2. Get out of the turret.
3. Remove the ammunition can.
4. Open the access door on the bottom of the ejected link and cartridge case container on the bottom of the turret, dumping the empty cartridge cases and links.
5. Field-strip the gun by removing its working parts. Clean and inspect the gun receiver. Then detail-strip the parts you have removed from the gun. Clean them and make a thorough check of their condition. Do not leave excess oil or cleaning fluid in the turret.
6. Report any malfunctions of the gun or turret noted on the mission.



ERCO TEAR DROP TURRET

ERCO 250TH—1 AND 2

The Erco 250TH Turrets have the approximate shape of a tear drop. They are installed in the waist positions on either side of the PB4Y-2 airplane—the Erco 250TH-1 on the starboard side and the Erco 250TH-2 on the port side. With their wide cone of fire they protect the plane from beam or belly attacks, besides offering a considerable area of protection from above. In operation they are somewhat similar to a ball type turret inasmuch as the gunner moves with his guns and sight in the direction he moves his control handles.

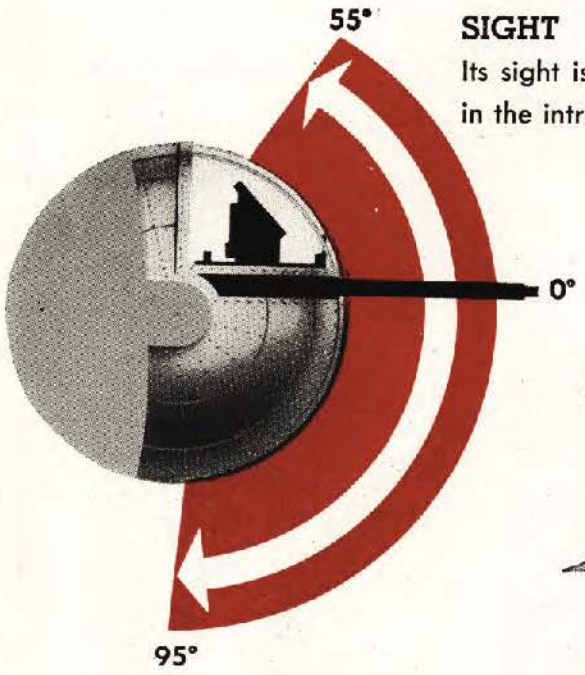
Facts and Figures

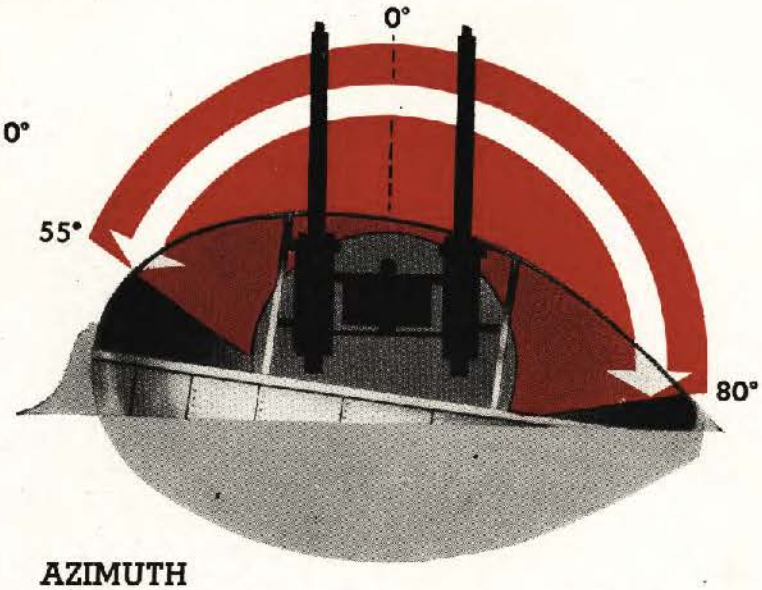
POWER

The Erco Tear Drop operates hydraulically on pressure built up by a hydraulic pump driven by a constant speed electric motor.

SIGHT

Its sight is a standard Navy Mk 9 reflector sight fully described in the introduction to this section.





ELEVATION

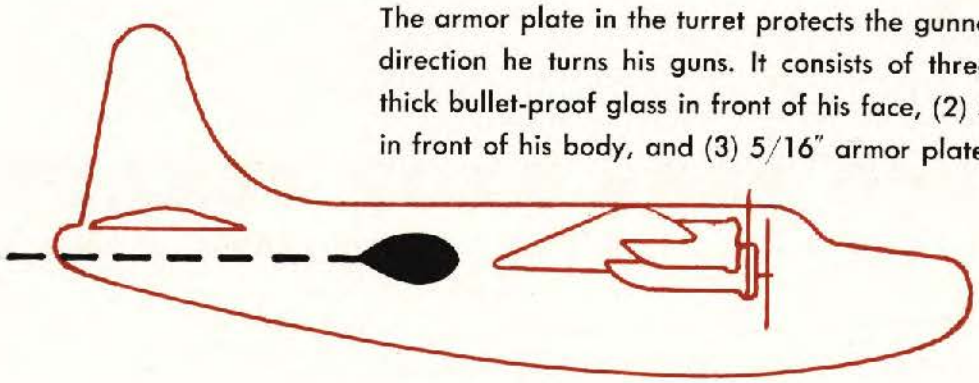
Both turrets can raise their guns 55° above horizontal in elevation and depress them 95° below horizontal.

AZIMUTH

In azimuth, the Erco Tear Drop turret allows the guns a movement of 135°, 55° towards the bow from the beam and 80° towards the tail of the airplane from the beam.

ARMOR

The armor plate in the turret protects the gunner from fire in any direction he turns his guns. It consists of three groups: (1) 1½" thick bullet-proof glass in front of his face, (2) 5/16" armor plate in front of his body, and (3) 5/16" armor plate under his feet.



STOWING

The stowing position is 0° elevation with guns pointed in the extreme aft position in azimuth (80° aft of the beam).

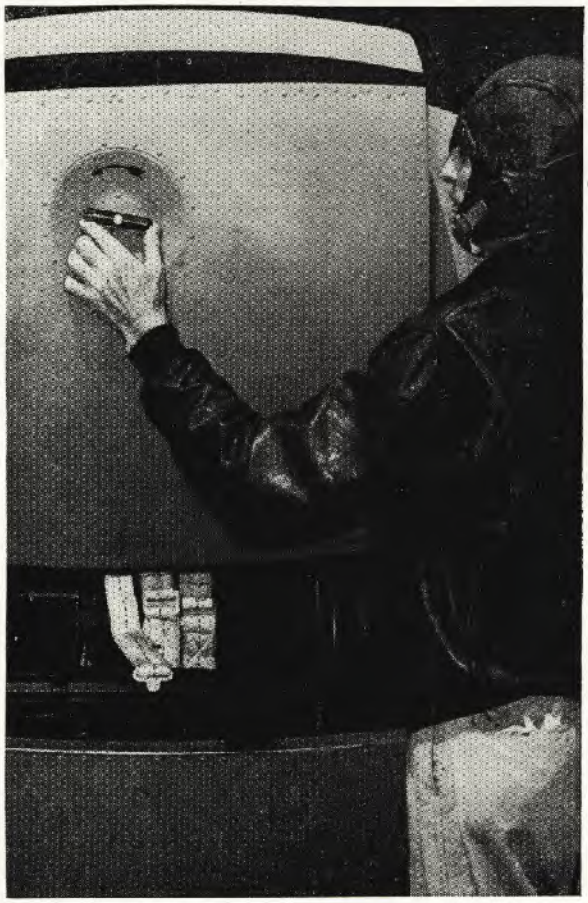
Getting In

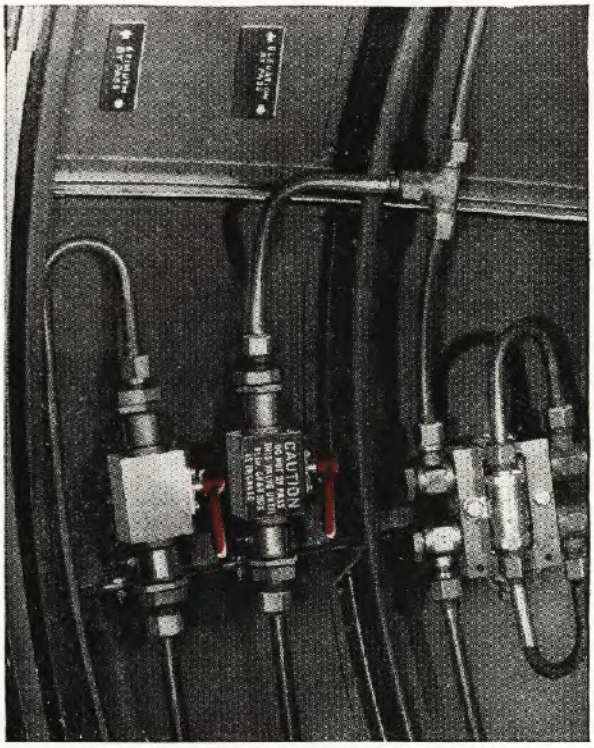
Now that you have been introduced to the Erco Tear Drop Turret, the next thing you must learn is how to get in the turret. You will find this an easy job. However, you must pursue the following steps carefully, or you might seriously injure yourself or damage the turret.

To begin with, have your flight engineer throw on the **waist turret** switch on the flight engineer's panel.

On a junction box, mounted to a bulkhead conveniently located near the turret, is the **main power** switch, along with a **push release button** switch and a **red indicator light.** Flick this main power switch to the **on** position. The push release button is provided for emergency use only in turning off the power to the turret.

You are now ready to get into the turret. Turn the handle counterclockwise on the entrance door in the back of the turret and raise up the door to its stowed position. Inside the turret on the forward inboard side, right next to the





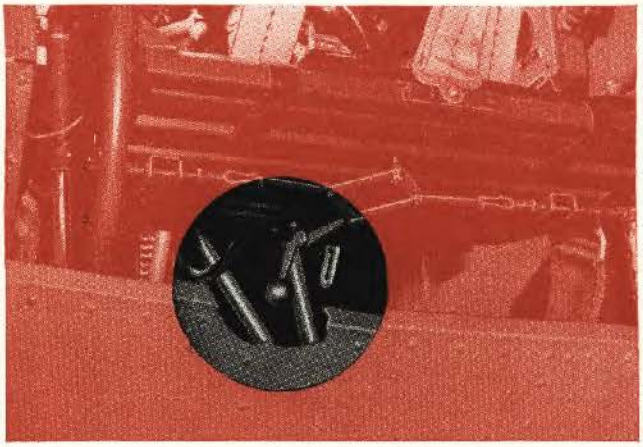
entrance door, you will see two levers painted red and marked **elevation by-pass valve** and **azimuth by-pass valve.** Make sure these levers are in the **down** position.

As your turret is in the stowed position, it will be necessary to move the seat and guns in azimuth to a right angle from the center line of the plane for you to get in. To do this, raise up the azimuth by-pass valve lever which frees the seat and guns so that you are able to move them around to the desired position. Lock the seat and guns in position by turning the azimuth by-pass valve lever down.

Unhook the back of the turret seat and swing it back. Be sure you keep the shoulder harness over the back of the seat.

Duck your head under the top of the door and put one leg into the turret. Grasp the tubing on either side of the sight to assist yourself and slide in on the seat. Reach around behind you and snap the seat back rest into place.

Now that you are seated, take a look through the **sight** to determine if you are at the proper height. If not, reach down between your legs under the seat and grasp the **seat adjustment lever** so that you may raise or lower the seat to the desired position.

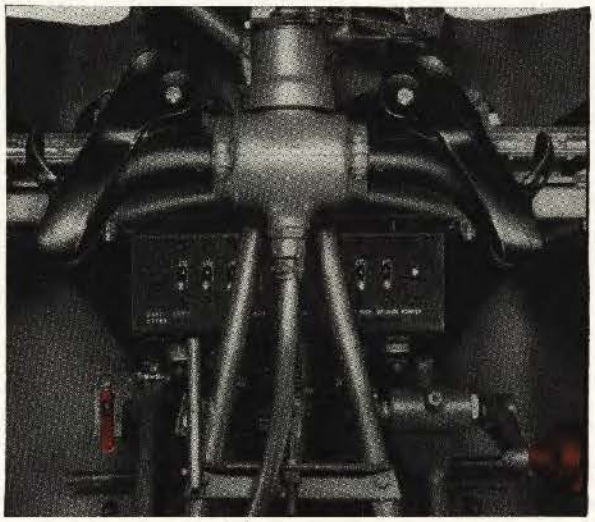


You have yet to close the entrance door; so reach around in back of you to the side and lift up again the azimuth by-pass valve lever, which we spoke about before you entered the turret. This frees your turret in azimuth so that you are able to move your seat around freely. Using the upper ribs of the turret as a hand grip, push your seat around so that you have your guns pointing aft. Reach around and lift the bottom of the door, freeing it from the locks in the channel guide. Then carefully let the entrance door down. Grasp the handle in the top section of the door; open the door latching handle in the bottom section, and pull the door in sharply, releasing the latching handle so that the door locks. Check the latching handle to see that it is completely secured. Now turn the azimuth by-pass handle to the **down** position, making the turret ready for power operation.

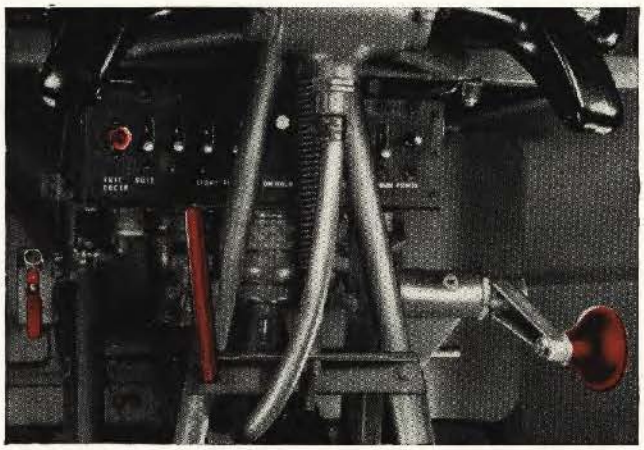
Put on the shoulder straps and fasten the safety belt. You will need them in this turret.

OPERATING THE TURRET

. . . Where to Find the Controls
. . . How to Use Them

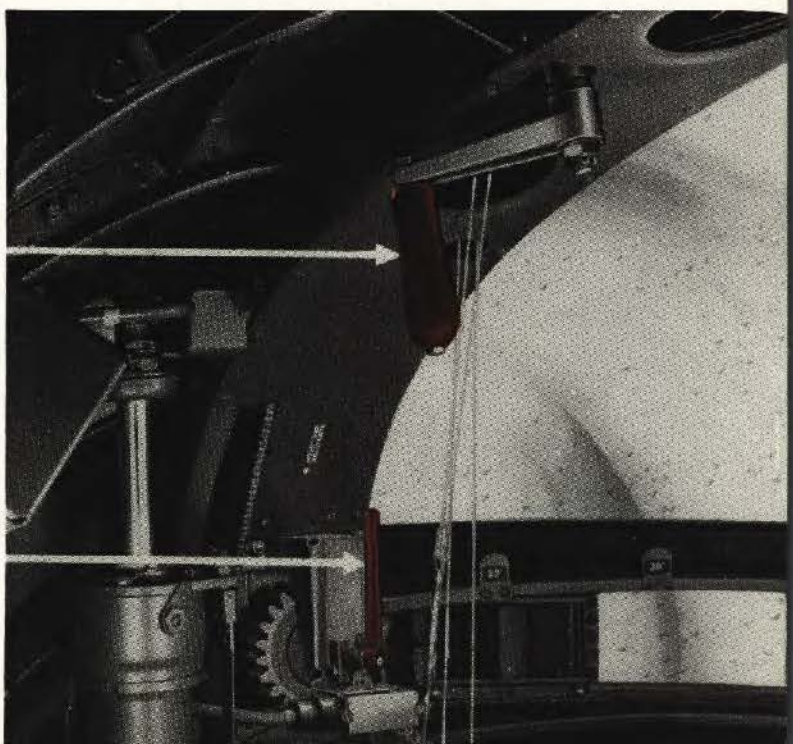


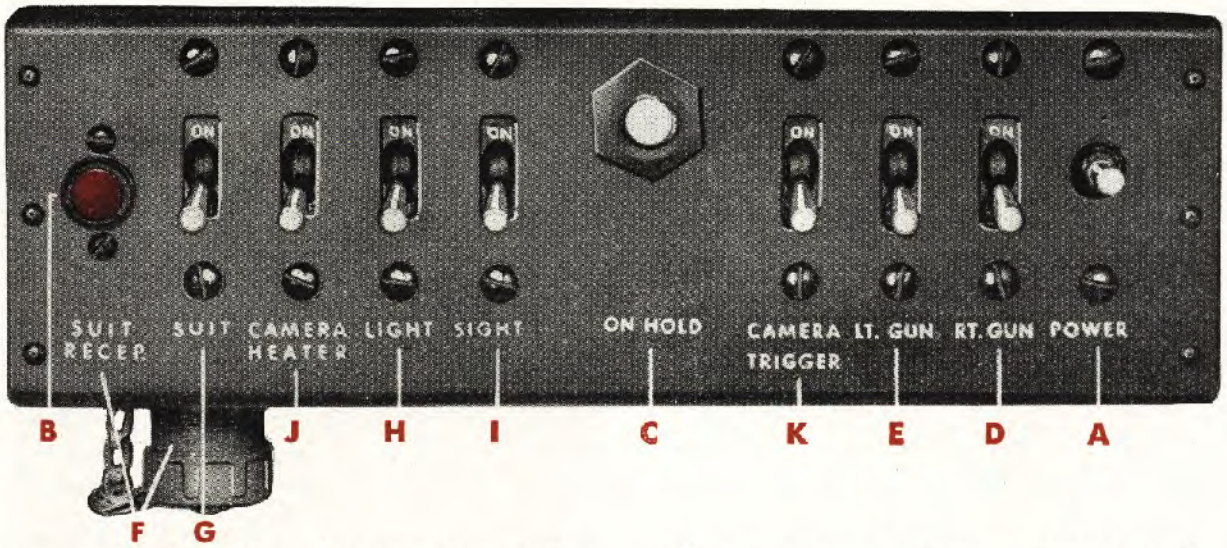
The **control panel** with all the switches for operating the turret is directly in front of you, behind the **control handles.** With a few clicks of the switches you will be able to put the Tear Drop Turret into operation.



First of all, check to determine if the **manual azimuth** and **elevation clutches** are disengaged before attempting power operation. This is very important as each clutch is equipped with a switch which cuts off the power to the turret when the clutch is engaged. The azimuth clutch is operated by a **red bar handle** next to your knee. Check to see that it is in a stowed position and that the turret will not move when you turn the **azimuth hand crank,** located next to the other knee. The elevation clutch has a **red handle lever** on the forward trunnion of the turret, which should be in the **up** position. To insure disengagement of the elevation clutch, operate the **elevation hand crank** in the top aft portion of the turret. The turret should not move.

With these checks made you are now ready to turn on the power. Hold down momentarily the





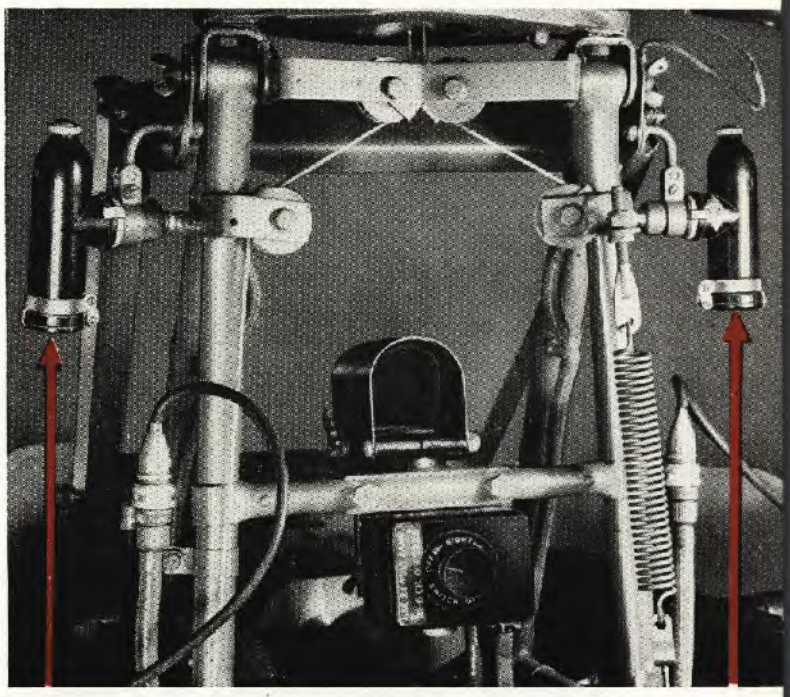
power switch (A) on the control panel; the **red indicator light** (B) should light up, as well as the one on the junction box outside of the turret. These lit-up indicator lights show you that the power is on in the turret.

To operate the turret, grasp the control handles in front of you, depressing the safety switches which start the pump motor. Turn the handles in the direction you desire to move the turret. For azimuth (right or left), the handles are operated like those of a bicycle. For elevation, move the upper part of the handle grips backwards, and for depression, move the top portion of the handles forward. Don't jerk the controls—move them smoothly and deliberately. If for any reason the power in the turret cuts cut, it may be possible that the circuit breaker to the pump motor is overheated. As a measure of immediate action, depress with one hand the **on-hold** button (C) which will by-pass the circuit breaker. Operate the control handles with the other hand.

The guns may be fired singly or together. They are controlled by gun selector switches marked **right gun** (D) and **left gun** (E) on the control panel. The **triggers** are right under your index fingers on both control handles. Either trigger will fire both guns, together or singly, as you may determine by your gun selector switches. Under your thumb on the top front part of the control handles are the **red interphone buttons.** Press either or both buttons when you wish to speak.

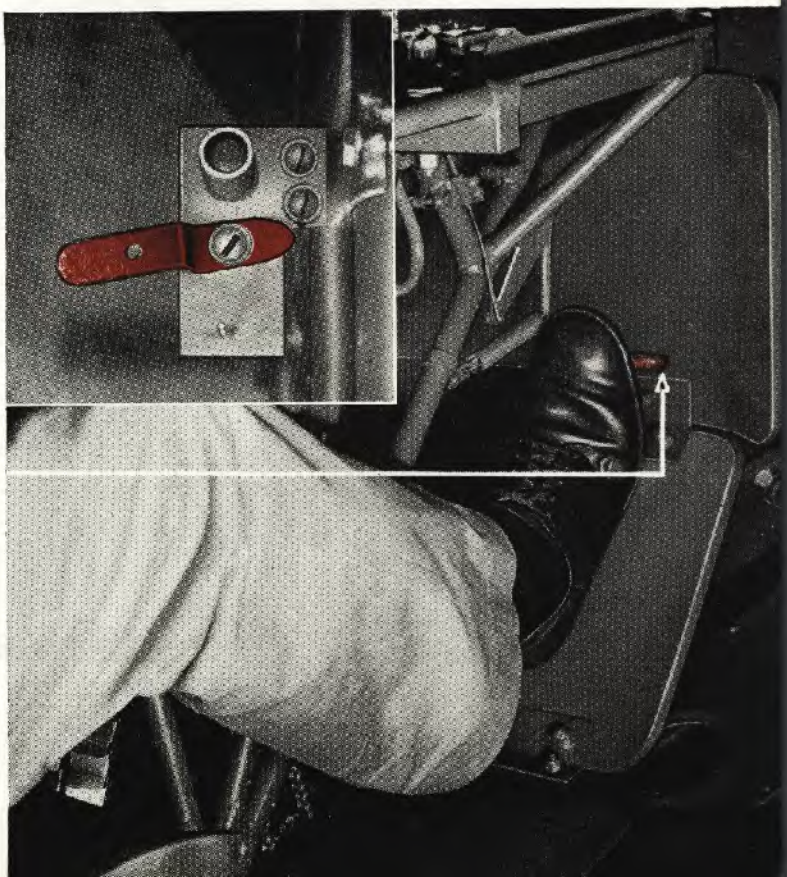
In front of you, on each side, are the two caliber fifty machine guns with hand charging handles on the outboard side of each gun. Reach forward, palm up, and grasp the hand charging handle firmly. Give a quick pull backward; then release the charging handle smartly and let it slide forward by itself. Repeat the procedure for the other gun.

Using Auxiliary Units



The turret is provided with a diluter demand type **oxygen system** fed into the turret through the aft trunnion from the airplane's main oxygen system. To control the amount of flow of oxygen to the oxygen mask, a regulator is mounted in the bracket in the top inboard side of the forward section of turret. The cord to your **heating suit** is plugged into the **suit receptacle** (F) in the bottom of control panel and is turned "on" and "off" by a **heating suit switch** (G) in the same panel.

Trouble lights, of the spotlight type, provided with swivel joints to direct their beams, are mounted at the top of the sight supporting structure. The **light switch** (H) to control these lights is on the control panel. To turn on the sight, flick the **sight switch** (I) to the **on** position on the control panel. No other switch in the turret need be on.



Provisions have been made for installing a **camera** in back of the armor plate in front of the bullet-proof glass face plate. To operate the camera turn on the **camera heater** (J) and **camera trigger** (K) switches on the control panel. Squeezing the triggers will put the camera into operation. The **interphone jack box** is located above your hip on the aft side of the seat. This is where you will plug in your interphone jacks for your head set and microphone. If the power fails, a **foot firing** mechanism is provided. Reach down by your knee and turn up the **red safety catch.** Then by depressing the **red bar** above your foot the guns are fired.

Manual elevation and azimuth hand cranks are provided to move the turret without power. To put them into use it is necessary to pursue the following procedure: Release the red azimuth clutch bar next to your knee; then reach in back of you and lift the azimuth by-pass lever. By operating the hand crank next to your other knee azimuth movement is obtained. For elevation manual operation, engage the elevation clutch on the front trunnion by turning down the red handle; then raise up the elevation by-pass lever in back of you. By turning the elevation hand crank at the top of the turret you will be able to move the turret up or down. If either of the clutches do not slip in easily, work the hand cranks back and forth until they do.

This manual method of operating the turret will be of little use to you as a gunner in combat. However, you will find this manual control very helpful in positioning the turret and in harmonizing the guns and sight when a small amount of carefully controlled movement is desired.

Getting Out

Get out of the turret just as carefully as you got in. Turn the turret to the stowing position —0° elevation and 80° aft of the beam in azimuth—guns pointing aft. Disconnect any auxiliary units you may have been using. Reach around in back of you and unlock the door latching handle. Grasp the handle on the upper section of the door and push out. With your other hand, grasp the bottom of the door, lift up, and stow the door in the channel catches provided. Move the turret to 0° elevation and to the beam in azimuth. Turn off all switches.

Unclamp the seat back and climb out of the turret. Reinstall the seat back.

Reach inside the turret and lift the azimuth by-pass lever and shove the guns and seat around in azimuth by hand to the stowing position—0° elevation—guns pointing aft. Depress the azimuth by-pass valve lever.

Emergency Exit

It may be necessary to get out of the turret in a hurry. If that is the case, an emergency exit is provided through the entrance door, either

outside of the airplane or into the airplane. To escape outside of the airplane turn the turret down to its maximum depression to bring the upper section of the entrance door to the outside of the airplane. Pull out the two pins that hinge the two sections of the entrance door together and push up the upper section so that you can crawl out of the turret. To escape into the airplane run your turret to 0° elevation and to a right angle from the center line of the plane in azimuth. Pull out the hinge pins to the entrance door and push the door out.

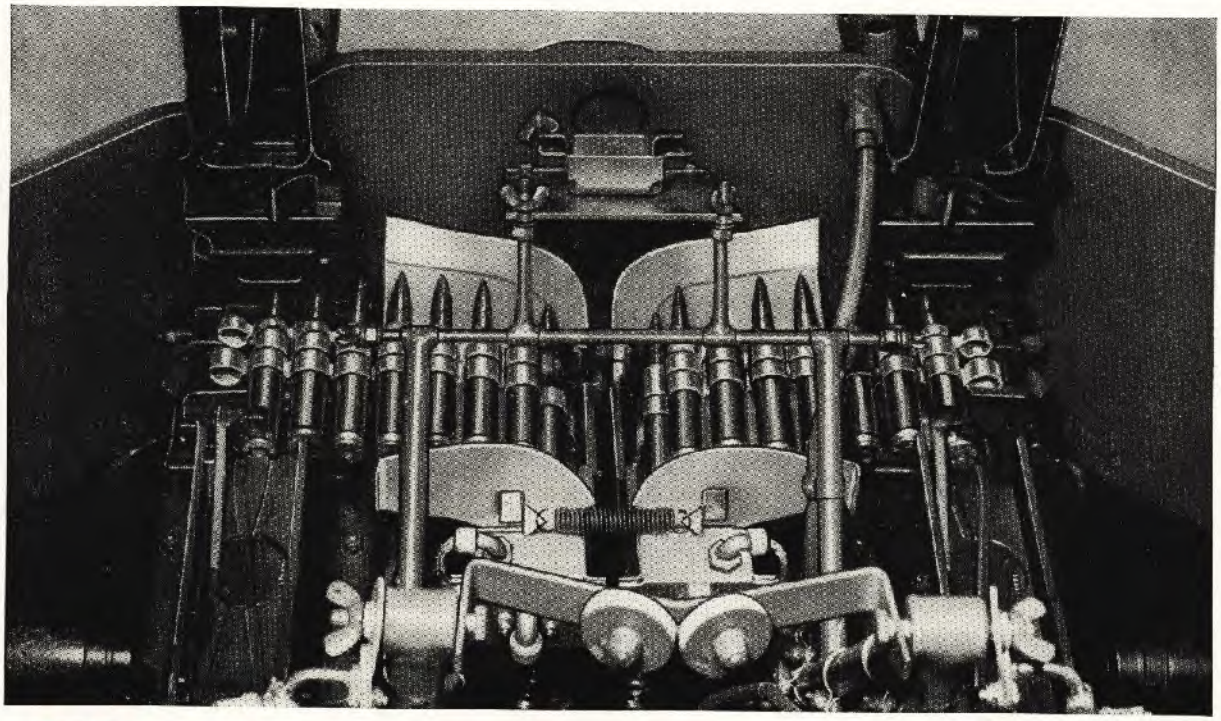
If your plane is still in the air, don't forget to snap on the chest pack parachute which is stowed on the aft inboard side of the turret.

Preparing the Turret for Combat

The preceding pages have illustrated how you get in and operate the Erco Tear Drop Turret, and how to get out again. From this information, you could take over and operate the turret in combat. If you specialize in the Erco Tear Drop, however, that will only be part of your duties. The rest of your job—adjusting the sight and guns, harmonizing them, and loading the ammunition for a mission—is explained in the following pages.

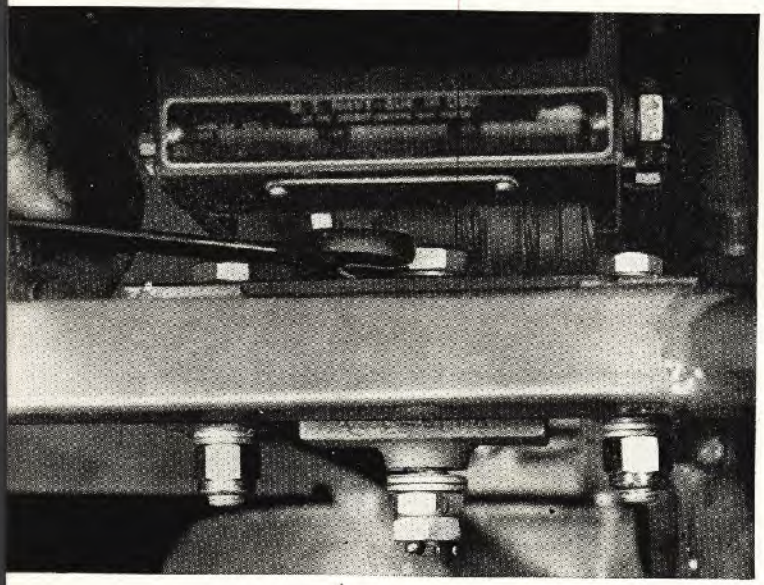
The Sight

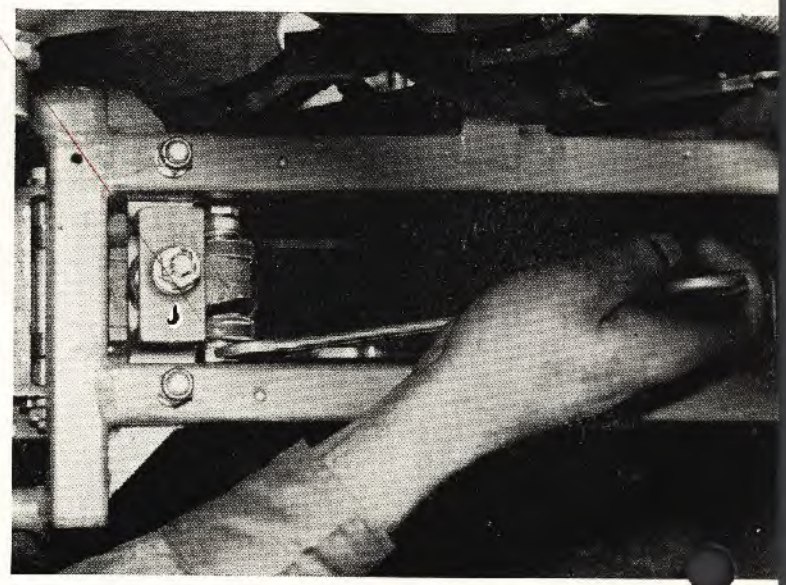
The Navy Mk 9 sight fits into the gunsight bracket directly behind the laminated bullet-proof glass. To adjust the sight, as may be sometimes necessary in harmonizing it with the guns, make your adjustments on the sight head. For full instructions in making these adjustments see the section on the Mk 9 sight in the general introduction of this section.



Adjusting the Guns

The guns are mounted in the Erco Tear Drop Turret to feed from the inside—the right gun feeds from the left and the left gun feeds from the right. Each gun is mounted in a Bell Mount Adapter. The rear support of the adapter is provided with an assembly containing an elevation adjustment bolt and an azimuth adjustment bolt to move the gun up, down, or sideways. When boresighting, adjustment of the guns is accomplished by holding the proper adjustment bolt head with a wrench and after loosening the jam nut and nut, turning the bolt. On completing your boresighting don't forget to tighten both nuts on each adjustment bolt.





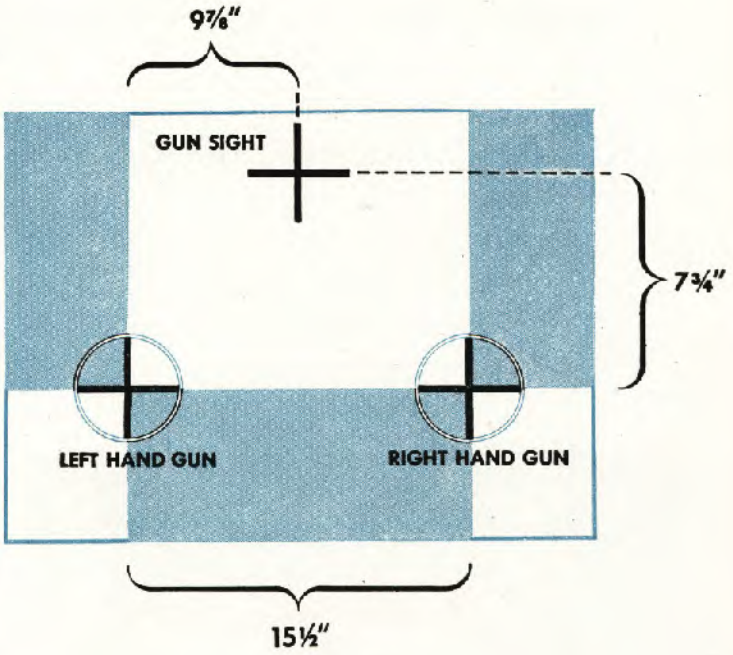
Harmonizing the Guns and Sight

There are a number of ways to harmonize the guns and sight of the Erco Tear Drop 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 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 turrets until the guns point at the object you have selected.

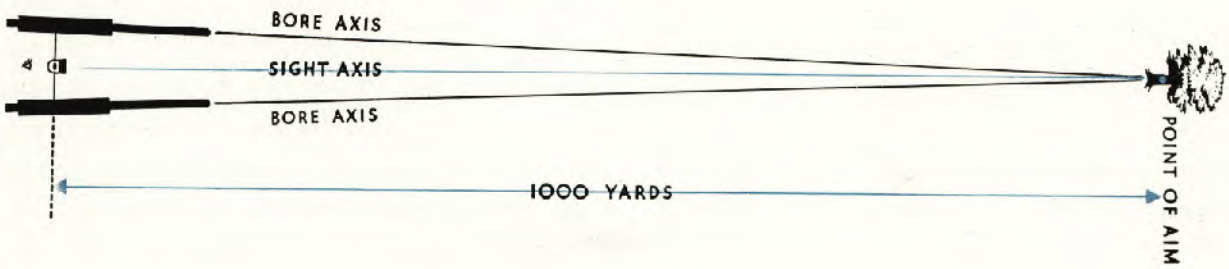
Then line up the sight, using the elevation and azimuth hand cranks to move the turret, until the dot of the sight is squarely on the object. Don't move the turret again.

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

Sometimes, the amount of adjustment possible in the rear mounts of the guns may not be large enough to bring the guns to bear on the object. In that case boresight each gun independently on the small object selected. Then you must make an additional adjustment on the sight head, to line up the dot of the sight on the same object.



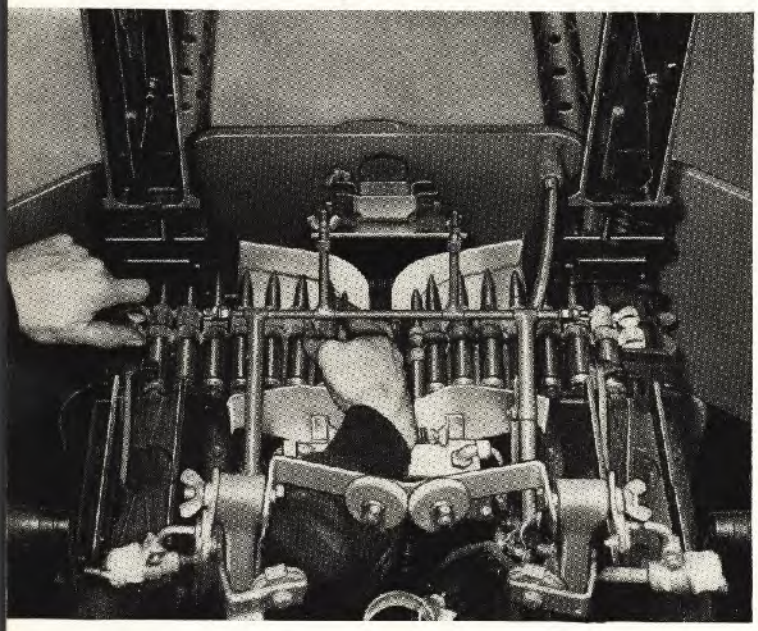
Another method of harmonization is to line up the sight and guns on a special pattern stand or template such as the one illustrated above. Set up the stand as level as possible at least 50 yards from the side of the plane. Center the guns in their mounts. Then boresight each gun on the pattern stand 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 called parallel harmonization.



Loading Ammunition

The ammunition magazines for the Erco Tear Drop Turret are located inside the airplane and fed into the turret through the aft trunnion. To load the ammunition:

1. Carefully flake the ammunition belt down in each magazine—projectiles pointing outboard.
2. Rotate the gun carriage to the beam in azimuth for loading the guns.
3. Make sure the gun firing switches are turned off on the control panel.
4. Push the ammunition belts through the tracks until the ends extend above the track bends between the foot armor plates.
5. Drop a wire down through each booster-feed channel and tie it to the ammunition belts. Pull the ammunition belts up over the boosters to ammunition feedway of guns.



Removing Empty Links and Cartridge Cases

To remove the empty cartridge cases and links from the expended ammunition containers on either side of the seat, roll the turret a few degrees above horizontal and move the guns to either extreme in azimuth. One of the expended ammunition containers will now be in front of the entrance door. Pull out the latching pin on the access door in the back of this container and raise the access door on top of the expended ammunition container. Reach down and push out the empty cartridge cases and links. Close the access doors and reinstall the latching pins. Run turret in other extreme azimuth position and repeat procedure.

Pre-Flight Routine

. . . Follow Step by Step

1. Install barrel and oil buffer groups in the guns, leaving out the bolts and back plates.
2. Check harmonization of guns and sight by boresighting on a pattern stand or some other object 1000 or more yards away.
3. While harmonizing the guns and moving the turret by the manual azimuth and elevation hand cranks, check and make sure the clutching arrangements are working satisfactorily.
4. Make sure the bolts are assembled properly to feed from the right for the left gun and from the left for the right gun. Then install the bolts and back plates on both guns.
5. Try to rock the guns in their mounts to make sure they are securely mounted. Check to determine if the jam nuts are up tight.
6. Operate the hand charging units on the outboard side of each gun.
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 if they are properly fitted and screwed up tight.
10. Check carefully to determine if there is any foreign matter on the bottom of the turret so that they will not foul the drive bands which control the azimuth movement. Keep the safety belt up while operating the turret.
11. Check oxygen connections to be sure they are tight.
12. Make sure the plexiglass windows and bullet-proof glass are properly cleaned.
13. Check for ease of operation in elevation and azimuth. Stop turret with pump running (control handles in neutral) and check for creep.
14. Check for "line knock" (air and hydraulic system) while operating the turret in all extremes. If any is noticeable, report it to the maintenance man.
15. Operate the turret in extreme elevation, depression, and azimuth to determine if the limit stops are functioning properly.
16. Insert a test light in place of the electric triggers and with the triggers depressed, swing the turret across the portions of the ship into which the guns could fire. The test light will go out in this area. With a boresighting tool, check the distances from the surface that the interrupter cuts out.
17. Turn on sight switch and rotate the sight rheostat from dim to bright to adjust the brightness of the reticle, and make sure this rheostat is working properly.
18. Test both filaments of the sight bulb to determine if they are good. If either is burned out, replace the bulb. Check for spare sight bulbs in the stowage clips over the aft corner of access door inside turret.
19. Make sure the reflector plate of the sight is clean.
20. Turn on the power, charge the guns, and then depress your safety switches—squeeze either trigger—listen for the "click" of the firing pins in the guns. Both guns should fire from either trigger at the same time, pro-

viding that both gun selector switches are turned on. Test the other trigger by repeating the operation.

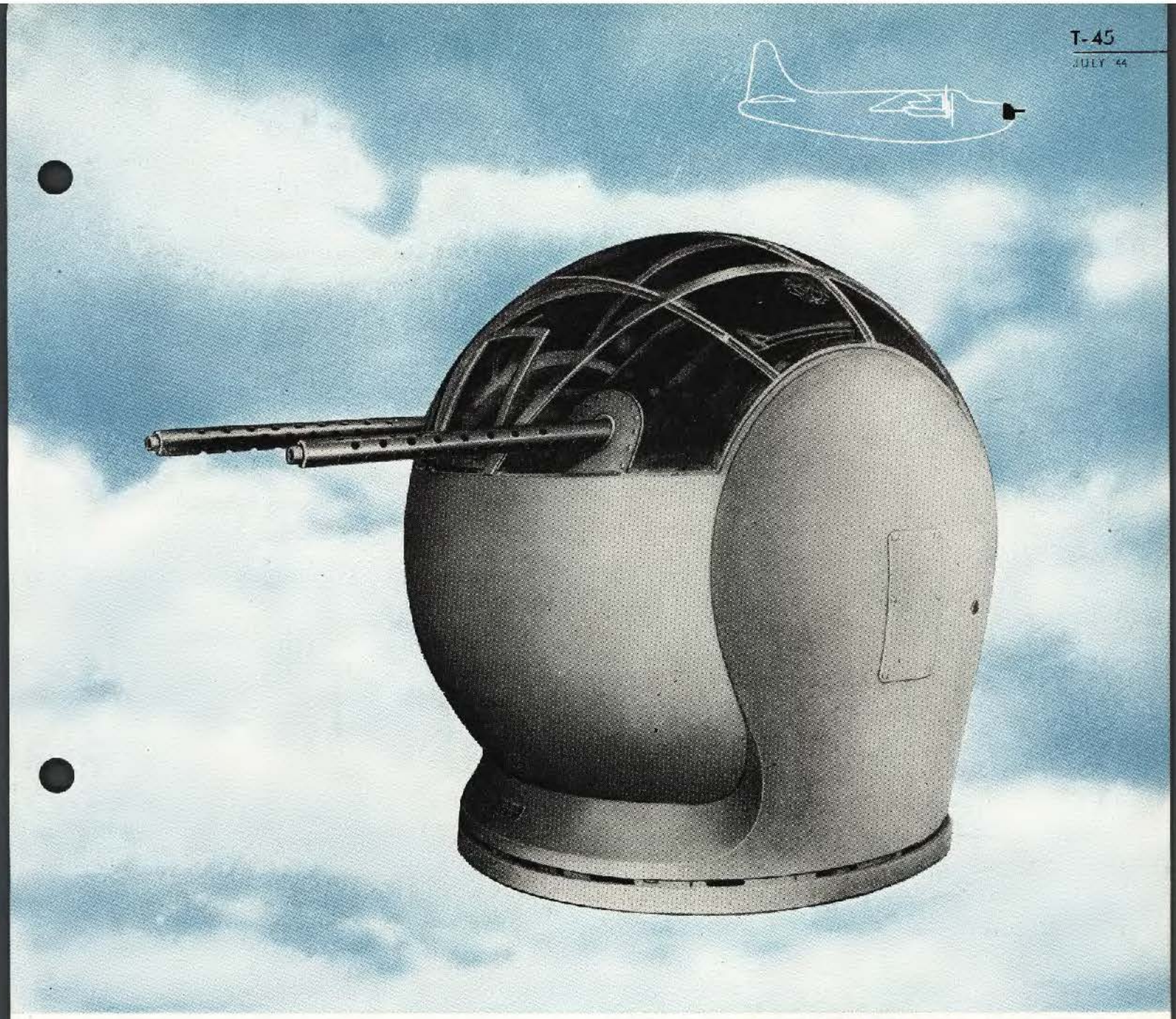
21. Put on the oxygen mask, connect it, and make sure you are getting the proper flow of oxygen. Check the regulator to determine if it is functioning correctly.
22. Plug in your headphones and microphone and test interphone system.
23. Plug in your heating suit and make sure it begins to heat.
24. Make sure the trouble lights operate. Replace any bulbs that fail to function.
25. Inspect all ammunition belts for condition and proper belting.
26. Check the booster motors by tipping them towards the guns. Make sure that they cut "on" and "off" sharply without lagging.
27. Load all four ammunition magazines in the airplane. Turn off power in turret. Feed the double link through the ammunition feeds into the turret and up over the booster motor's sprockets. Place the first round into the feedway of the gun. You will not charge the guns until in the air and ordered by the plane captain.

Before Landing

1. Run your turret into its stowed position—0° elevation and the guns in the extreme aft position in azimuth (80° from the beam).
2. Clear the guns by lifting the gun covers, removing the ammunition, and hand charging them twice.
3. Remove ammunition belts from feedways.
4. Open the entrance door.
5. Run the turret to 0° elevation and to a right angle from the center line of the ship, in azimuth. Turn off all switches.
6. Get out of the turret.
7. Lift up the azimuth by-pass valve lever and shove the turret to its stowed position. Depress the azimuth by-pass valve lever.
8. Close the entrance door.

After Landing

1. Remove all ammunition from chutes and magazines.
2. Open access door in the back of the expended ammunition containers on either side of the seat and clean out the cartridge cases and links. Relatch access door upon completing the job.
3. Field strip the guns.
4. Clean and inspect the gun receivers and detail strip the parts you have removed. Clean and check their condition.
5. Do not leave excess oil or cleaning fluid in the turret.
6. Report any malfunction of the guns or turret noted on the mission.



Erco Ball Turret

ERCO 250SH—2, 2A or 3

The Erco Ball Turret is the bow installation in the Navy PB4Y-1 and PB4Y-2 airplanes. It serves a double purpose in taking care of any bow attacks on the Liberator besides being used for strafing, in anti-submarine warfare. Inasmuch as this turret is of the ball type, the gunner moves with his guns and sight in elevation and azimuth as he moves his control handles. It is a relative of the Martin 250SH Bow Turret of the PBM-3 airplanes and has many points of similarity in design and action.

There are several models which for the most part are the same—the Erco 250SH-2 or 2A used in the bow position of the PB4Y-1 airplane and the Erco 250SH-3 used in PB4Y-2 airplane.

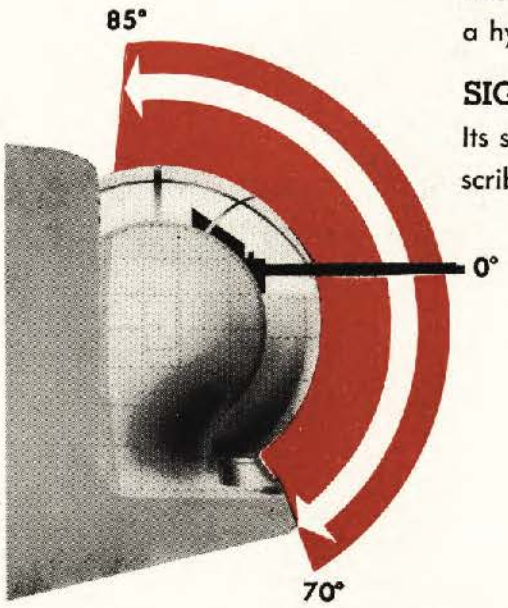
Facts and Figures

POWER

The Erco 250SH operates hydraulically on pressure built up by a hydraulic pump driven by a constant speed electric motor.

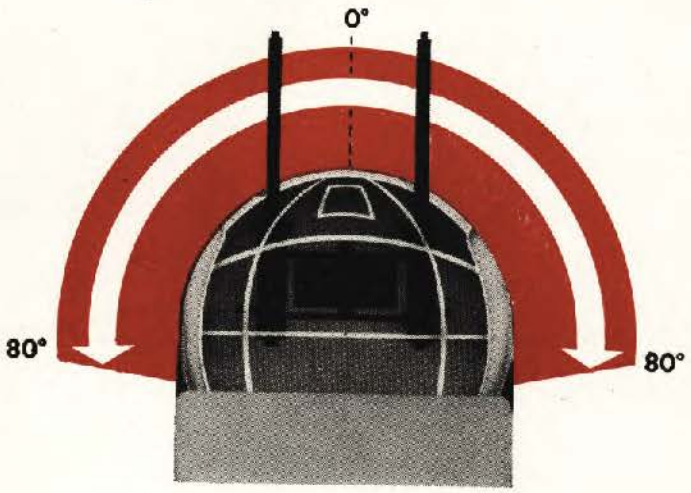
SIGHT

Its sight is the standard Navy Mk 9 reflector sight, fully described in the introduction of this section.



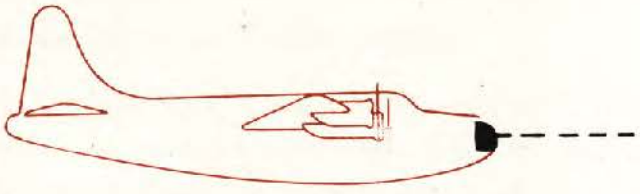
ELEVATION

From the horizontal position the turret ball, and consequently the guns, may be depressed a maximum of 70° and elevated a maximum of 85°.



AZIMUTH

This type of turret is capable of revolving 360° in azimuth, but for the installation in the bow of the PB4Y-1 or PB4Y-2 airplanes, its motion is restricted to 80° either side of the center line of the plane.



STOWING

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

ARMOR

The armor plate of the turret consists of three parts to protect the gunner from enemy fire and flak:

(1) 1½" laminated bullet proof glass to protect his face.

(2) ½" armor plate in front to protect the gunner's body, no matter where his guns are pointed.

(3) ¼" armor plate bolted to the floor to protect his feet.

Getting In . . .

Now that you are becoming acquainted with the Erco Ball Turret, you should realize that, like all other bow turrets, it is no place to be during a take-off or landing. Your additional weight in the bow would put undue stress on the airplane, besides making the ship unbalanced; therefore, never enter the turret until the plane is in full flight.

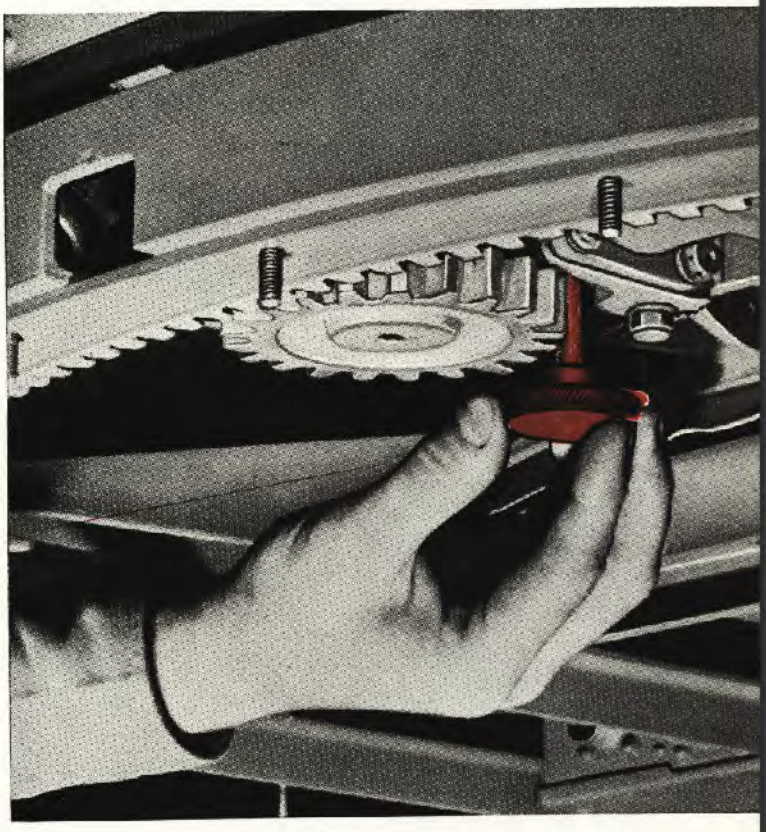
Getting into the Erco Ball Turret is a relatively easy job if you will pursue the following steps: First of all, make sure the **azimuth clutch** is engaged. The small round **red handle** on the bottom of the turret saddle on the azimuth gear box, must be in the **down** position. Then make sure that the **red handled elevation clutch** on the back of the saddle below the right hand corner of the entrance door has not been pulled out. Never try to get into the turret if the clutches are disengaged, as the turret ball will roll under your weight. This could be very dangerous to you besides damaging the turret.

Before entering the turret, throw the **main power switch** to the **on** position. This switch is located in a junction box mounted on the left bulkhead in the Liberator's nose, almost directly under the turret.

Open the entrance door in the back of the turret by turning the handle clockwise.

Check the control panel, which is located front center in the turret directly above the control handles, to make sure that all the switches are off. This will prevent the turret from moving and trapping you while you are in the doorway.

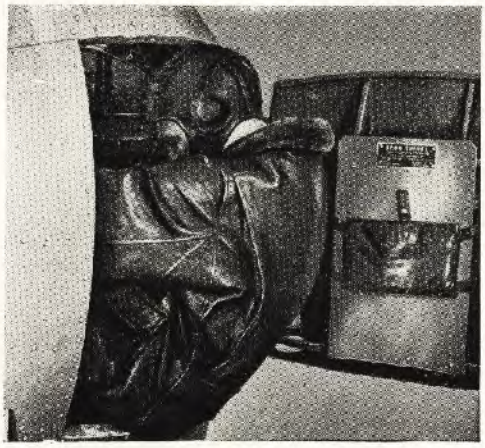
With both hands grasp the bar handle installed above the entrance door. Raise both feet simultaneously and swing into the turret,

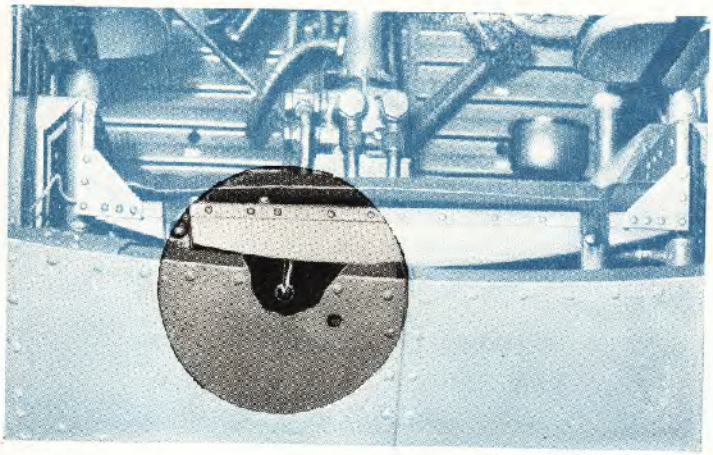


placing your feet on the foot armor plates below the front magazines.

Slide forward in the seat so that your head will clear the top of the door opening and swing forward to get your head inside of the turret. Close the door by a sharp pull on the bottom portion and secure the door latch by pulling down on the inner handle.

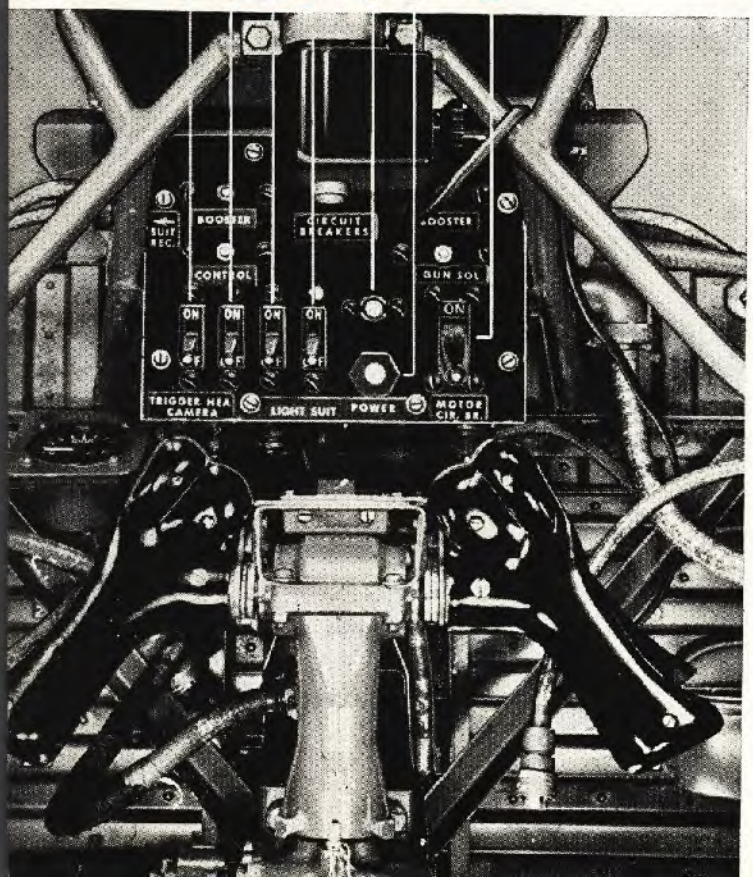
Check the door latch to see if it is secured by leaning back against it. Look through the sight and determine if you are at the proper level to see through it. If not, reach down between your legs and grasp the **seat adjustment lever** so that you may raise or lower the seat. Fasten the safety belt as you will need it. You are now ready to operate the turret.





Operating the Turret

F E G D C B A



. . . Where to Find the Controls . . . How to Use Them

The **control panel,** which you checked before entering, is above the **control handles** directly in front of you. All the switches which will put the turret to work are on the control panel. Be sure to turn them on in the proper order.

First, turn the **motor circuit breaker** (A) switch to the **on** position. Then, push and release the **power switch button** (B). A **red indicator light** (C) on the turret control panel should light up, showing you that the power is **on** in the turret.

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 neutral position without moving the turret. If the control handles are held in any other position than neutral and the safety switches are closed, the motor will start, causing immediate and possibly violent motion of the turret. Either safety switch will put the motor in operation.

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

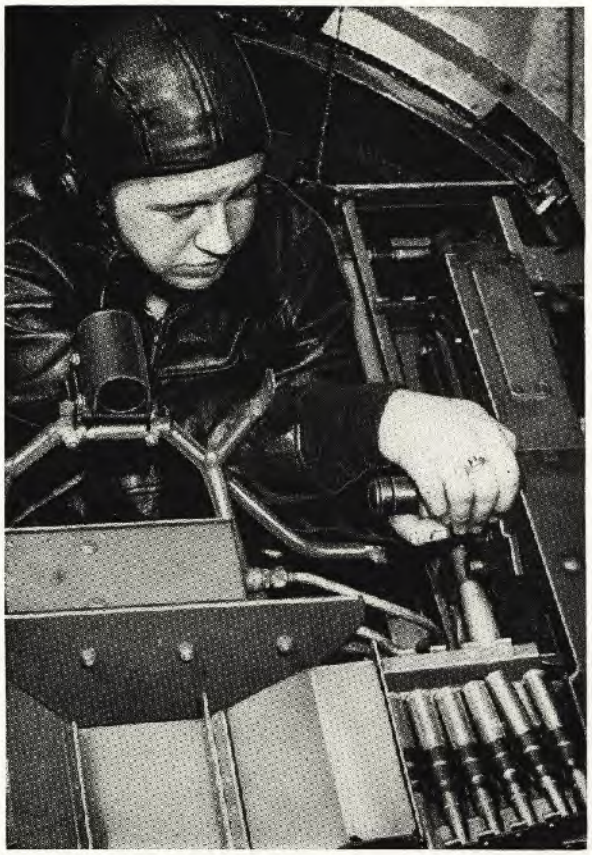
To adjust the brightness of the **sight** to lighting conditions use one hand to hold the control handles, keeping the safety switch depressed, and turn the sight rheostat with the other hand.

To operate the turret turn the 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 elevation, move the upper part of the handgrips backward, and for depression, move the top portion of the control handles forward. Don't jerk the controls—move them smoothly and deliberately.

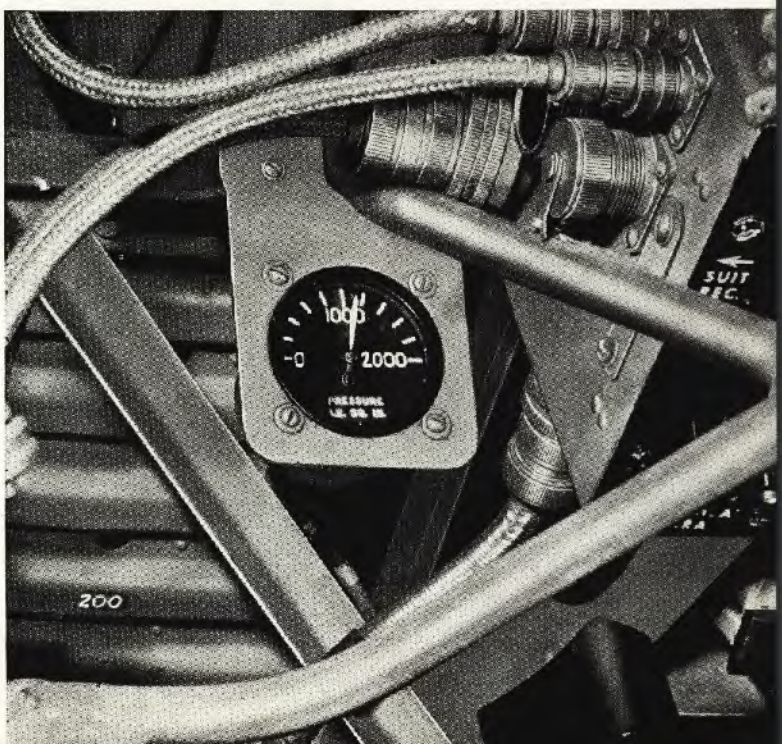
At the left of the control panel is the **hydraulic pressure gauge.** As soon as the pump is operating, check to see if it reads the desired **1150** lbs. pressure. While operating the turret, check this gauge from time to time to see if the proper pressure is maintained.

Directly under your index fingers on both control handles are the **triggers.** Either trigger will fire both guns.

On each side of you at shoulder level are the levers for hand-charging the guns. Grasp the

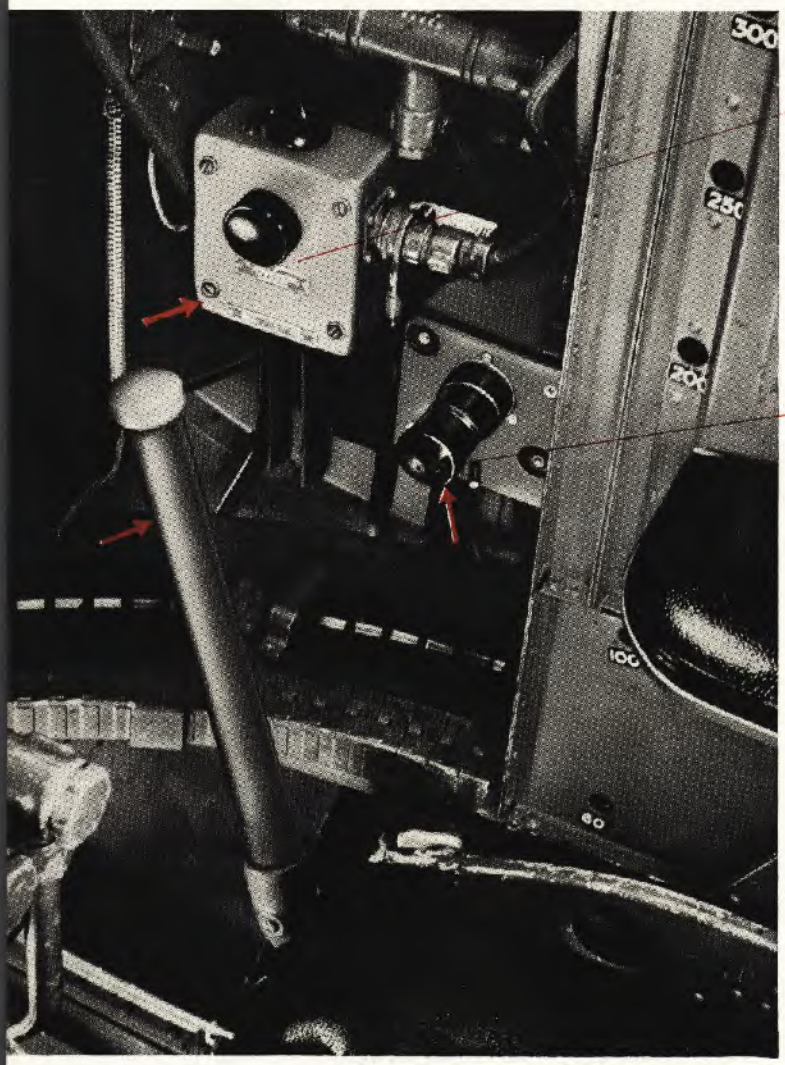


charging handle of one gun with both hands, one above the other, and give a quick, hard pull back. Then release the handle smartly and let it slide forward by itself. Repeat the procedure for the other gun.



Using the Auxiliary Units

The **oxygen system** in the turret is a complete self-contained unit, consisting of two oxygen cylinders and a regulator, which are located in the locker in the entrance door behind the back-rest. A hose connects the regulator to the oxygen mask. In the older type turrets, three cannisters are provided in individual brackets—one in the entrance door and one on each side magazine. Newer turrets are provided with oxygen equipment which makes the cannisters unnecessary.



The **heated suit** cord is plugged into an outlet on the left side of the control panel and is turned on by a **suit switch** (D) on the same panel. A **camera** is mounted in front and a little below the bullet-proof glass face plate. To put the camera into operation it is necessary to have the **camera heat** (E) and **camera trigger** (F) switches in the **on** position on the control panel and either of the safety switches and either of the trigger switches depressed. The **interphone jack box** is located on a bracket next to your right knee. This is where you plug in the jacks for your headphones and throat microphone. Installed on the front of the box is a **push-to-talk** button which operates the interphone system when you wish to speak.

A **light switch** (G) on the control panel operates an extension type **trouble light** mounted on the right side of the ball structure next to your right knee.

In the event that the electric drive motor fails, the turret can still be operated by working the **emergency hand pump.** Work the hand pump with the right hand and hold the left hand grip of the control handles turned in the direction you desire the turret to move. This hand pump will facilitate harmonizing the guns and sight when a small amount of carefully controlled movement is desired.

In the latest turrets an auxiliary foot firing mechanism is provided if the power to the guns fail. To put it into operation release the **red safety catch** over your right foot; then depress either **red bar** found above your feet and the guns will fire.

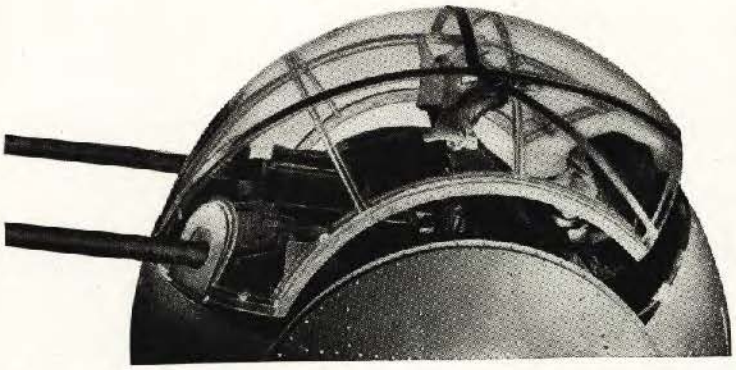
Getting Out

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

First, move the guns to stowing position—guns at zero elevation and zero azimuth; then, turn off all switches in the turret.

Disconnect any auxiliary units you have been using.

Reach around and open the door. Ease your body out of the turret by grasping the bar handles installed in the airplane above the entrance door.

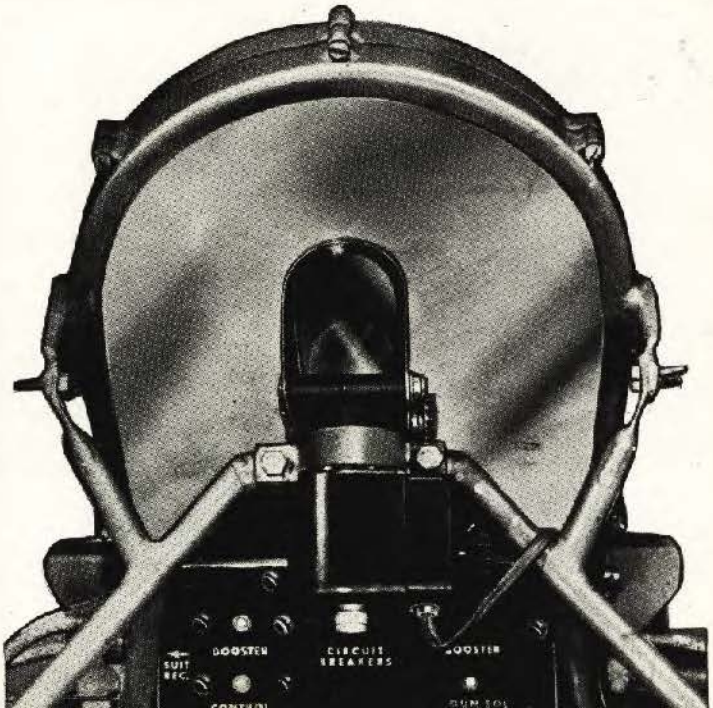


Emergency Exit

In the event that it is necessary for you to get out of the turret in a hurry, an emergency exit is made possible by removing the plastic canopy. This is done by releasing the latch mechanisms in the upper structure of the turret. Pull out the four red painted handles and push the canopy up and forward with both hands.

The Sight

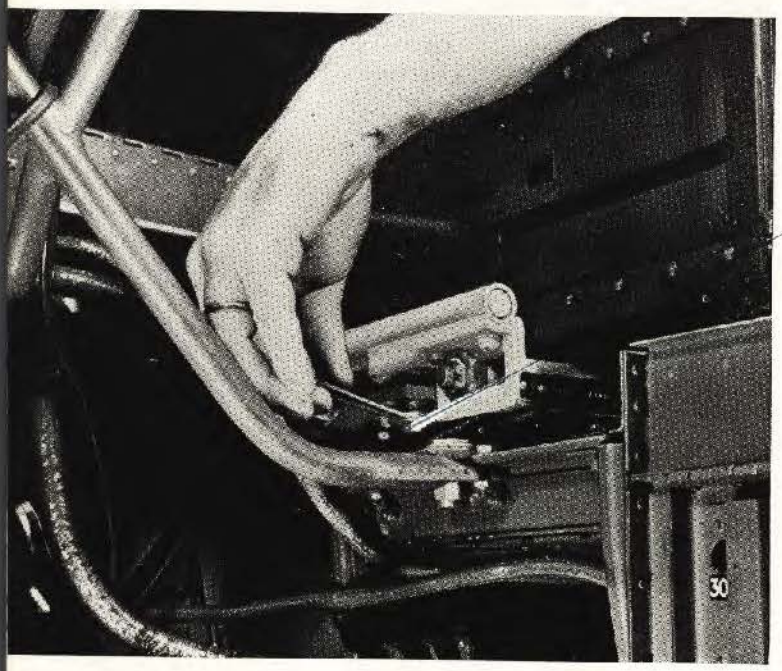
The Navy Mk 9 sight fits into the gunsight bracket directly behind the laminated bullet-proof glass. To adjust the sight as may be sometimes necessary in harmonizing it with the guns, make the adjustments on the sight head. For full instructions in making these adjustments see the section on the Mk 9 sight in the general introduction of this section.



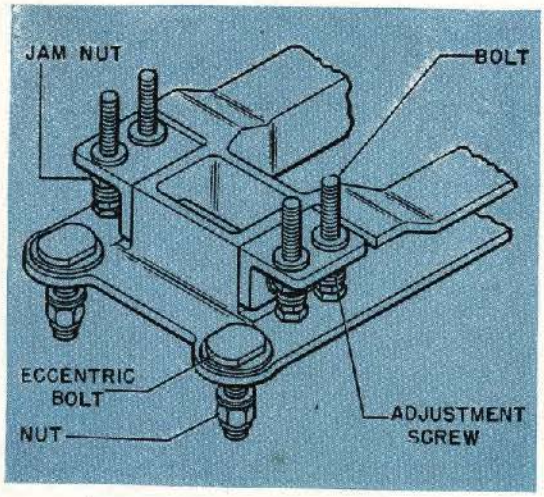
Preparing the Turret for Combat

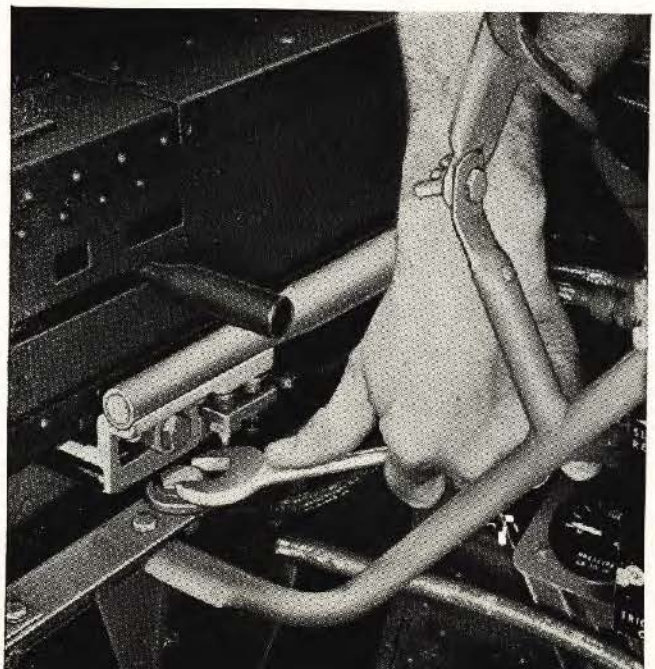
The preceding pages explained how to get in, operate, and get out of the Erco Ball Turret. From this information you could take over and operate the turret in combat. If you specialize on the Erco, however, that will be only part of your job. Other duties such as adjusting the sight and guns, and loading the ammunition for a mission, are explained in the following pages.

Adjusting the Guns



The guns are mounted in the Erco to feed from the inside; the right gun feeds from the left and the left gun feeds from the right. Each gun is bolted into a Bell Mount Adapter and adjusted in elevation by means of adjustment screws on both sides of the rear gun mount support. All four of these screws must be set with the jam nuts to secure the gun in position. The guns are adjusted horizontally in either direction by turning the eccentric bolts in the rear of the gun mount supports. The two rear bolts must be set tight with their elastic stop nuts in order to secure the guns in position. The front bolts should be loose enough to allow all boresighting to be done from the rear.



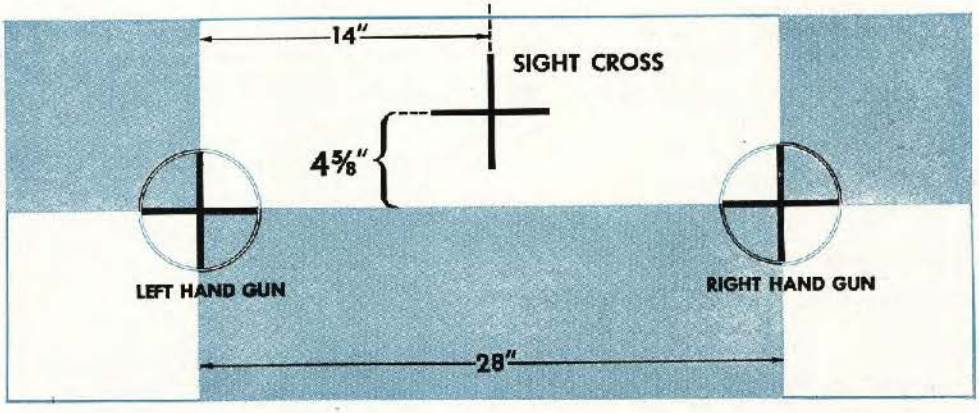


Harmonizing the Guns and Sight

There are a number of ways to harmonize the guns and sight of the Erco Ball 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. 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.

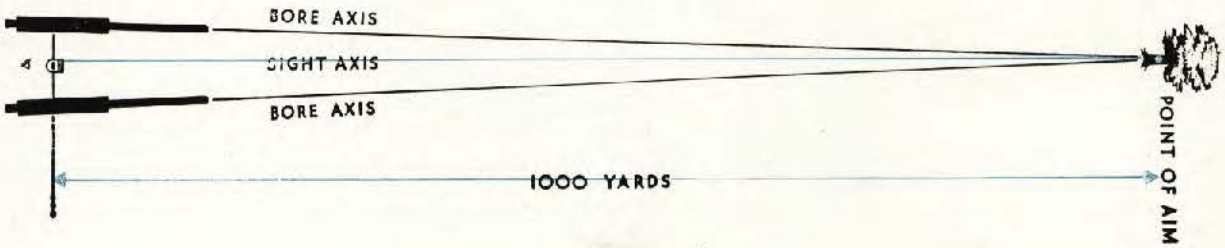
on is exactly in the center of each gun bore. Sometimes the amount of adjustment in the rear mounts of the guns may not be large enough to bring the guns to bear on the object. In that case, boresight each gun on the object selected. Then make the necessary adjustment on the sight head to line up the sight dot on the same object.

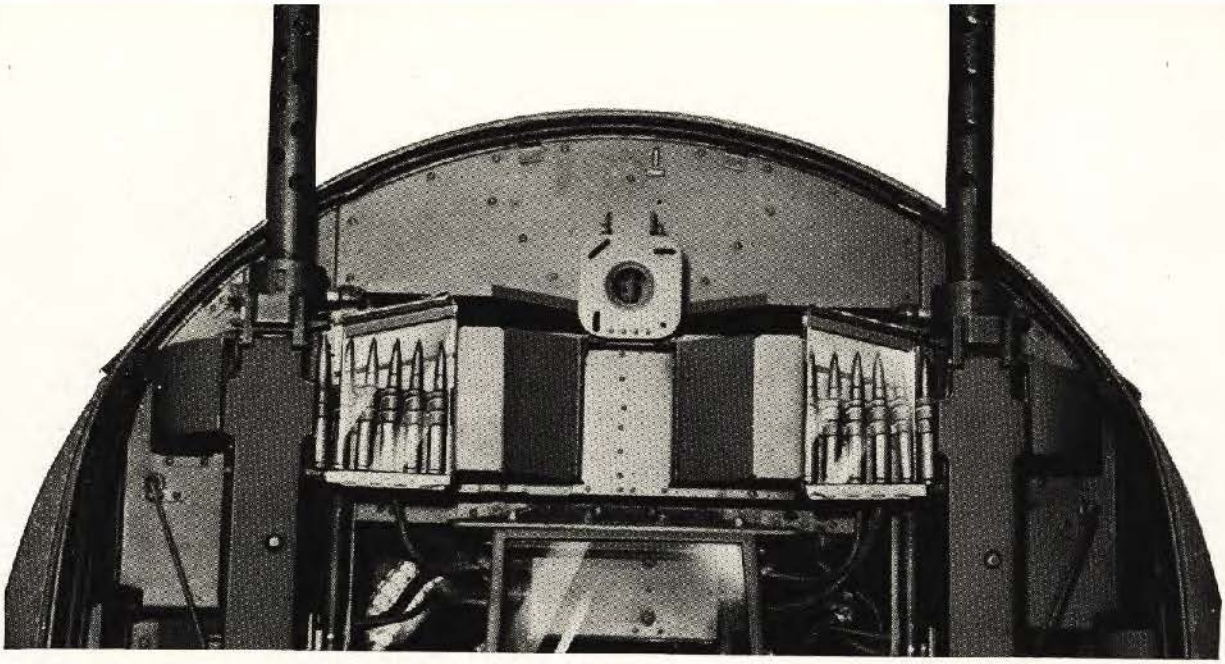
Another method of harmonization is to line up the sight and guns on a special pattern stand or template, such as the one illustrated here. Set up the stand as level as possible at least



Then line up the sight, using the emergency hand pump 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 screws and bolts until the spot the sight is centered

50 yards in front 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.





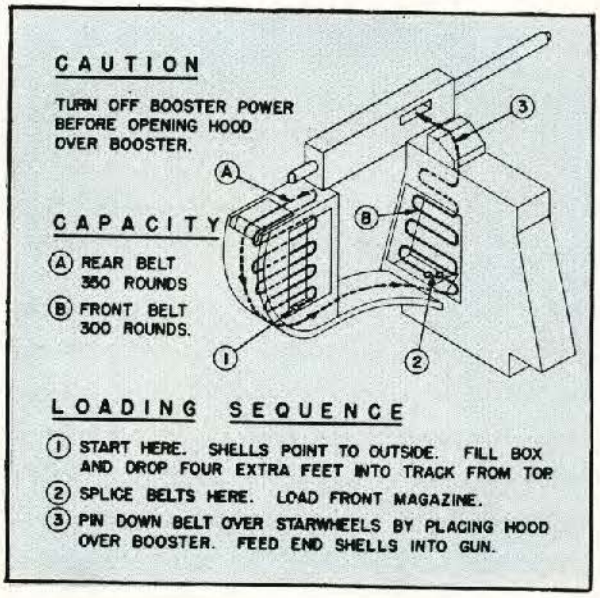
Loading Ammunition

Each gun in the Erco Ball Turret has two magazines, one in the side beneath the gun which it feeds, and the other at the front of the turret ball. In all, the total capacity of the four magazines is 1200 rounds.

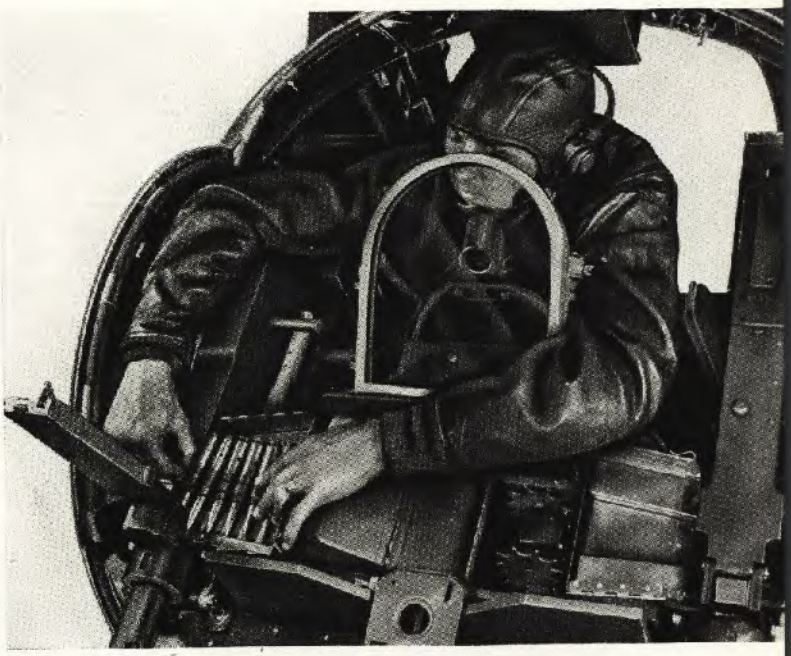
First of all, make sure the power is off.

To load the magazines:

1. Get into the turret, but do not close the entrance door.
2. Pull out the pins on the access doors of all four magazines, and slide the doors off.

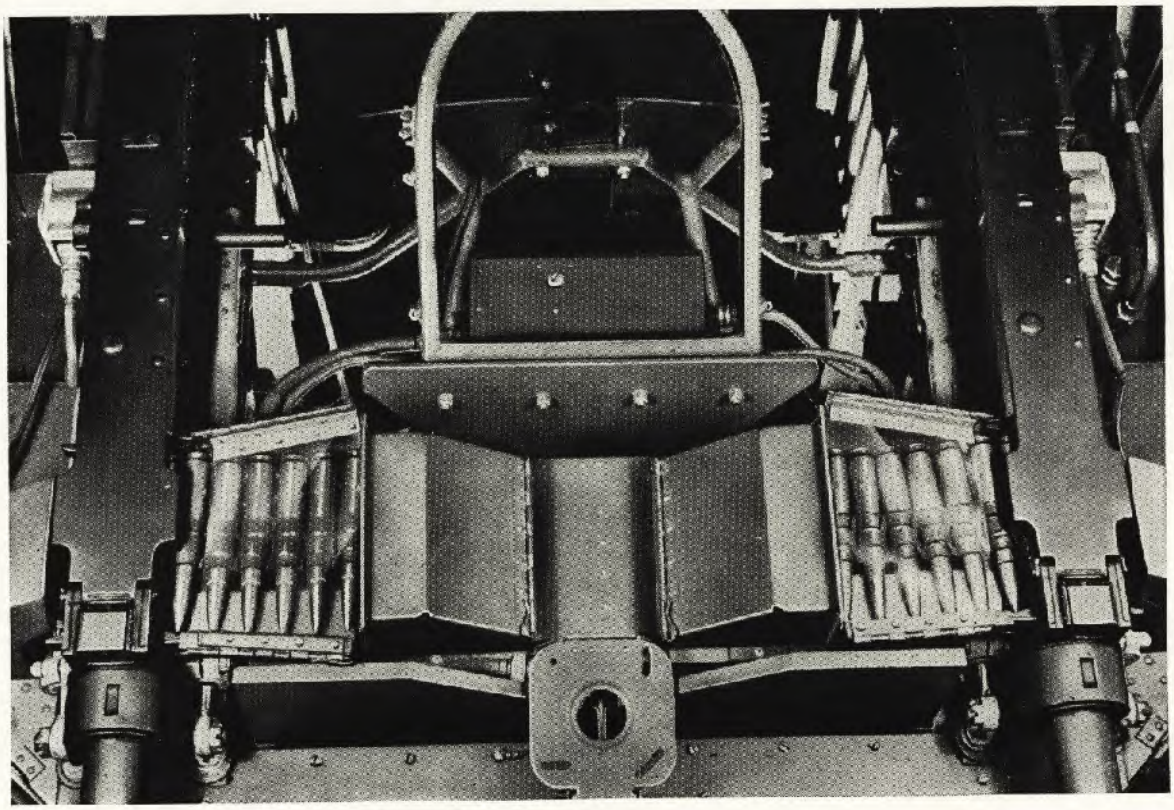


3. Remove the transparent ammunition track covers.
4. Fill either side magazine by passing the ammunition belt over your shoulder and down through the top of the magazine,



single link first, projectiles pointing outboard. Flake the belt down until the magazine is full.

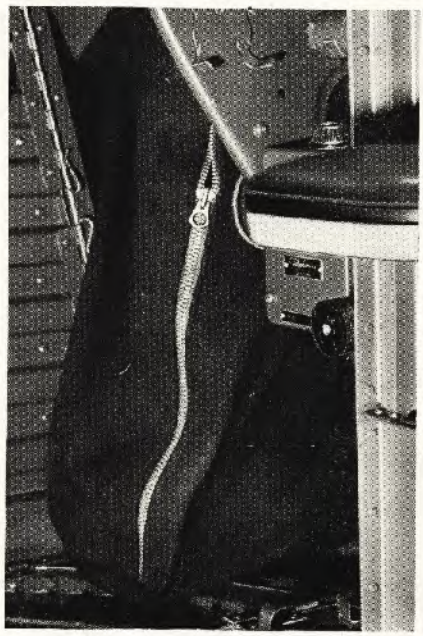
5. Pass the free end of the ammunition belt down through the ammunition track at the rear of the side magazine and up around the rollers to the bottom of the corresponding front magazine. About six feet of belted ammunition will be required to reach the front magazine.
6. Fill the corresponding front magazine by passing the ammunition belt over your shoulder and down through the top of the magazine, single link first, projectiles pointing forward.
7. Splice the ends of the ammunition belts of the front and side magazines.
8. Flake down the ammunition belt in the front magazine.
9. Run the end of the ammunition belt up over the booster sprockets. Lift the gun cover and insert the double link end of the belt into the gun.
10. Repeat the procedure for the other side.
11. Replace magazine access doors and transparent ammunition track covers.

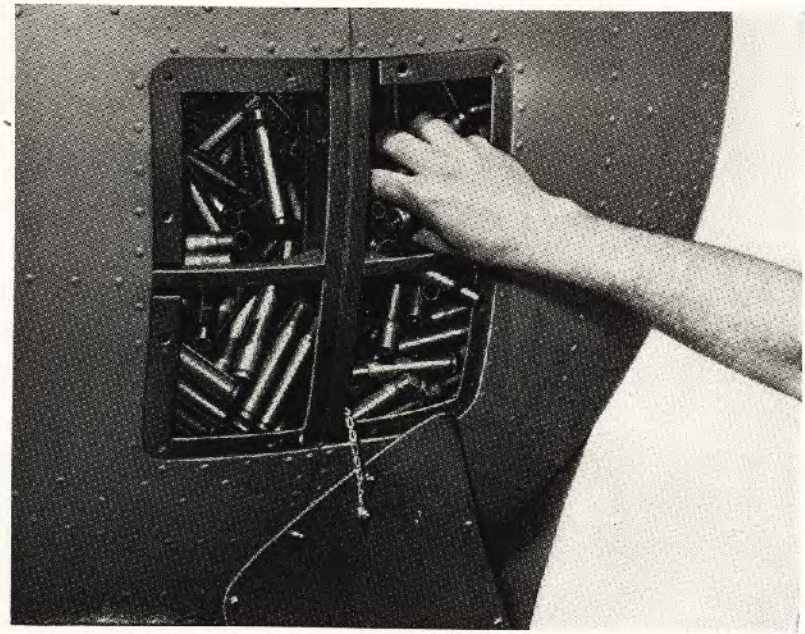


Removal of Empty Cartridge Cases and Links

The empty cartridge cases are removed from the empty cartridge case chamber in the front of the turret through an access door located on the outside lower front portion of the turret ball. After cleaning out this chamber, be sure to replace the access door securely.

The empty links drop into canvas bags held under the empty link chute on each gun. These bags are equipped with zipper openers to provide easy removal of the links.





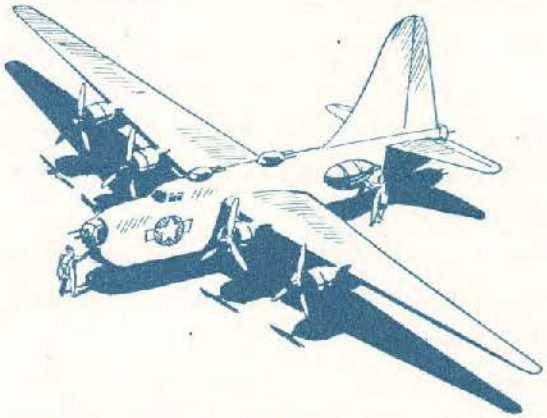
Pre-Flight Routine . . . Follow Step by Step

1. Install the barrel and oil buffer groups in the guns, leaving out the bolts and back plates.
2. Check the harmonization of the guns and sight by boresighting on a template or some small object 1000 or more yards away.
3. While you are harmonizing the guns and moving the turret by the emergency hand pump, make sure the hand pump is operating properly.

4. Make certain that the bolts are assembled properly to feed from the right for the left gun, and from the left for the right gun. Install the bolts and slide the back plates on both guns.
5. Try to rock the guns in their mounts to make sure they are securely mounted. Check to determine if the jam nuts are up tight.
6. Operate the hand charging handles on the inboard side of each gun.
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 the electrical leads and flexible conduits (Breezes) to determine if any are frayed or damaged.
9. Check all Cannon plugs to see if they are properly seated and screwed up tight.
10. Put on the oxygen mask, connect it, and make sure you are getting a flow of oxygen. Check the gauge to make sure there is the proper pressure as determined by your crew chief.
11. Check oxygen connections to be sure they are tight.
12. Make sure the plexiglas dome and bullet-proof glass are properly secured and cleaned.
13. Operate the turret to determine if the pressure gauge reads the required 1150 lbs. pressure.
14. Check for 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 the maintenance man.
16. Operate the turret in all extremes to determine if the limit stops are properly functioning.
17. Turn on the sight switch and rotate the sight rheostat from dim to bright to adjust the brightness of the reticle, and make sure the rheostat is working properly.
18. Test both filaments to make sure the sight bulb is good. If either is burned out, replace the sight bulb.
19. Make sure the reflector plate of the hood assembly on the sight is clean.
20. Turn on the power and charge the guns. Then, depress the safety switch and squeeze either trigger and listen for the "click" as the firing pins in the guns release. Both guns should fire from either trigger at the same time. Test both triggers by repeating the operation.
21. Plug in your headphones and microphone to test if your crew mates can hear you and if you can hear them.
22. Plug in your heating suit and make sure that it begins to heat.
23. Make certain that the trouble light operates. Pull the light out of its cord, making sure the retractable reel is working properly.
24. Inspect all ammunition belts to determine if the rounds are in good condition and properly belted. Check booster motors by tipping them toward the guns. Make sure that they cut on and off sharply without lag.
25. Load all four ammunition magazines. Feed the double link ends up over the booster motors' sprockets and press the first round into the feedway of each gun. You will not charge the guns until you are in the air and so ordered by your plane captain.
26. Make a last visual check of the whole turret.

Before Landing

1. Run the turret into its stowing position, zero elevation and zero azimuth, guns pointing straight forward.
2. Clear the guns by raising the gun covers, removing the ammunition, and hand charging the guns twice.
3. Remove all ammunition from feedway. Check all switches and make sure they are off.
4. Get out of the turret and close and latch the door.



After Landing

1. Remove all ammunition from chutes and magazines. Open access door in front lower portion of the ball and clean out expended cartridge cases. Replace this access door securely on completing the job. Remove used links from canvas bag held under the empty link chute on each gun. A zipper is provided to open the bag.
2. Field strip the guns by removing their working parts.
3. Clean and inspect the gun receivers, then detail strip the parts you have removed from the guns, cleaning them and making a thorough check of their condition. Do not leave excess oil or cleaning fluid in the turret.
4. Report any malfunction of turret or guns noted on the mission.

MARTIN BALL TURRET

MARTIN 250SH – 1A & 2

The Martin 250SH Ball Turret is found on all Navy flying boats using bow turrets. It is a complete self-contained unit with everything at your finger tips to make it hot for an enemy fighter flying a bow attack on your plane. In addition, you will find those two caliber .50 machine guns mighty efficient in cleaning a gun crew off the deck of a submarine. In this turret the gunner moves with his guns and sight in elevation and azimuth. Its appearance and operation is very similar to the Erco 250SH Turret.

The Martin 250SH Turret has been produced in two models, which are, for the most part, the same; the Martin 250SH-1A used in the bow of the PBM-3D, and the Martin 250SH-2 used in the same position on the PB2Y-3 airplane.

Facts and Figures

POWER

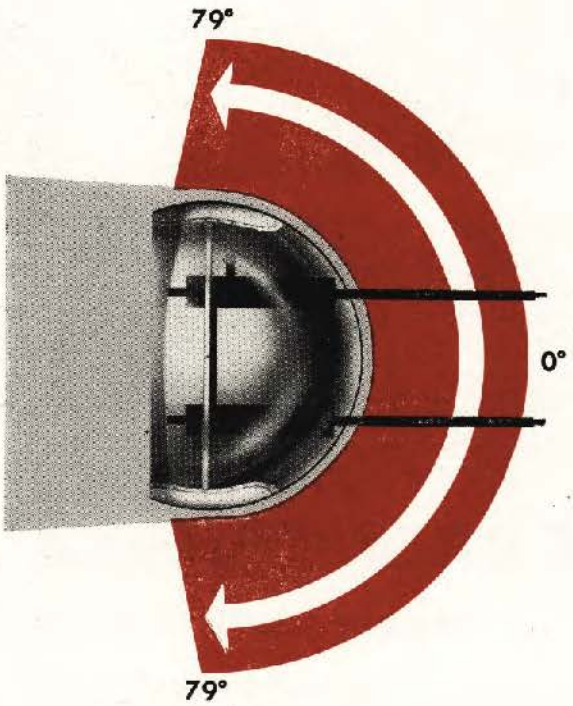
The Martin 250SH operates hydraulically on pressure built up by a hydraulic pump driven by a constant speed electric motor.

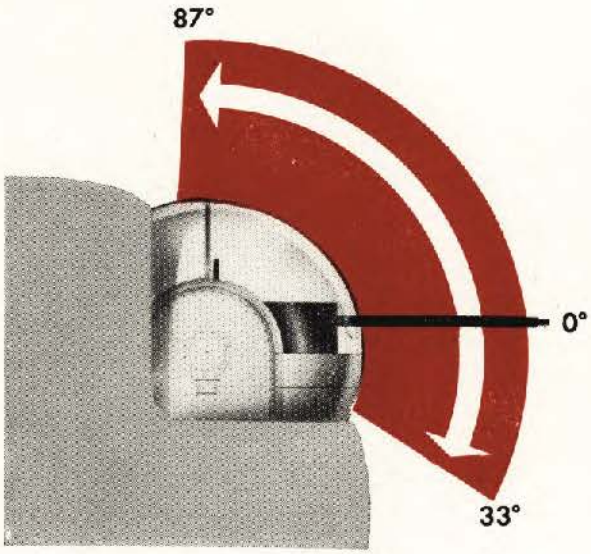
SIGHT

Its sight is a standard Mk 9 reflector sight, fully described in the introduction to this section.

AZIMUTH

The Martin Ball Turret in its installation in the PBM-3D and PB2Y-3 has an azimuth motion of 79° either side of the center line of the plane.





ELEVATION

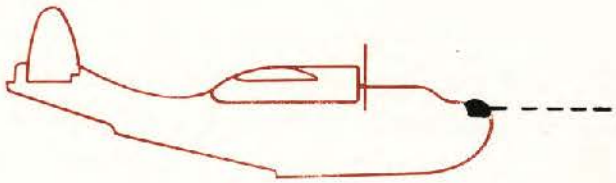
Both the Martin 250SH-1A and 250SH-2 turrets can be elevated 87° above the horizontal, and depressed 33° below the horizontal.

ARMOR

The armor plate in the turret protects the gunner from enemy fire in any direction in which he trains his guns. It consists of three groups: ⅝" steel armor plate in front of his face, ⅝" steel armor plate to protect the booster motors and ammunition chutes and ½" armor plate to protect his body and ammunition boxes.

STOWING

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

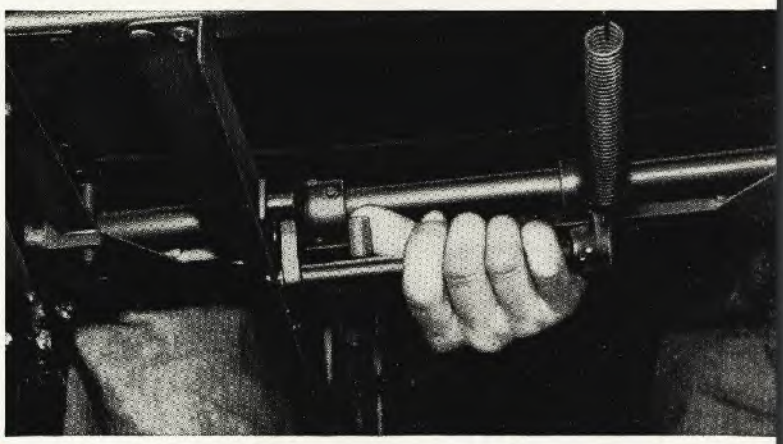


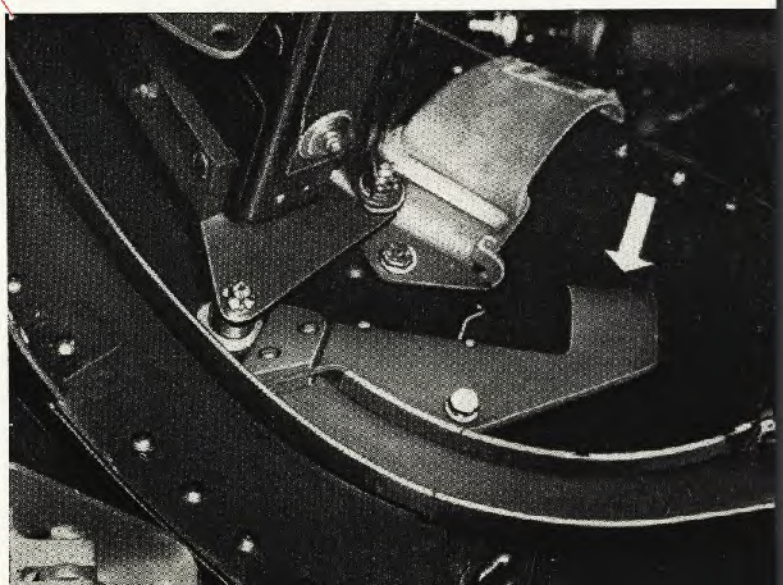
Getting In

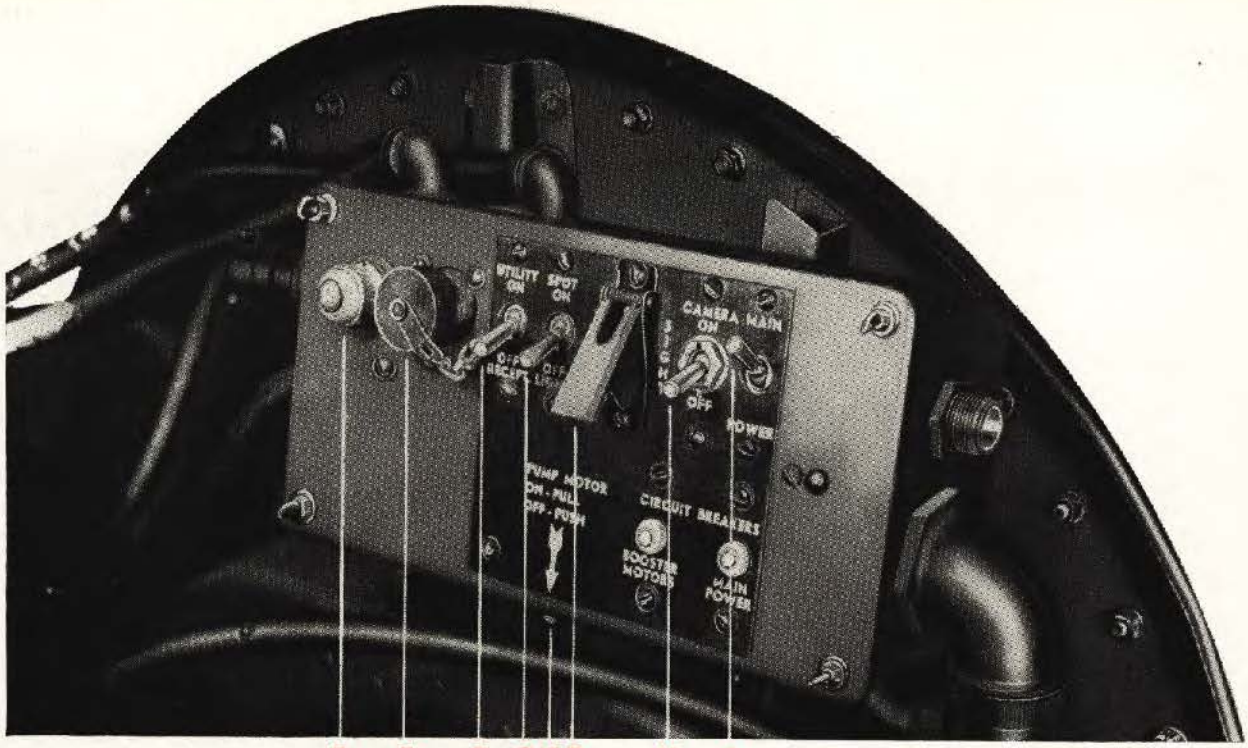
Remember, a bow turret is no place to be while landing or taking off. Your weight in the bow puts undue stress on the airplane—besides making the plane unbalanced; therefore, never enter the turret until the plane is in full flight.

Entering the Martin Ball Turret presents little difficulty if you take the following steps. Before you get in, have your flight engineer turn on the **bow turret switch** on the flight engineer's panel. Outside the turret in a junction box, conveniently located near the turret on a bulkhead, is a **red indicator light** and a **turret switch,** which turns the power to the turret **on** and **off.** In the turret is a similar switch marked **main power** with a **red indicator light** off to the side. Wait until you are in the turret to turn on the current, as the switch on the outside junction box is to be used for emergency purposes only.

Facing forward, enter the turret through the opening in the bottom and reach up, grasping the top of the face armor plate to assist in pulling yourself in. Once inside, reach down on your left side and release the **seat lock,** allowing the seat to follow the track to its seated position. Seat yourself and look through the sight to determine if you are at the proper height. If not, reach down under the seat with your right hand and grasp the **seat-adjustment handle.** With your thumb release the catch on the handle freeing the seat, and by moving the seat-adjustment handle up or down the seat will raise or lower. When you are at the proper height, allow the catch to spring back and re-engage; this locks the seat at the height you have selected. Adjust and fasten the safety belt. You will need it in this turret.







B E F G C D H A

Operating the Turret

. . . Where to Find the Controls
. . . How to Use Them

First of all, check the **low pressure gauge,** which is located to the side of your right ankle. This gauge should read **25** to **30** lbs. It is very important that this pressure be maintained as it insures smooth operation of the turret.

Unlock the **elevation landing lock,** which is on the forward left hand side of the ball, by pulling out and rotating the handle **up.** Then determine if the **azimuth position lock,** on the lower left hand side, is in the extreme **unlocked** position. These two operations free the turret.

On your upper right-hand side, you will find the **control panel.** Click on the **main power switch** (A), and the **red indicator light** (B) on the panel will light up as well as the red indicator light on the outside junction box, showing that the power is on in the turret.

Located on the bottom of the control box is another switch marked **pump motor** (C).

Flick this to the **on** position.

Lift the little red plastic cover on the control panel marked **gun and sight switch** (D) and raise the switch under it to the **on** position.

The **control handles** to operate the turret are located in front and above your knees.

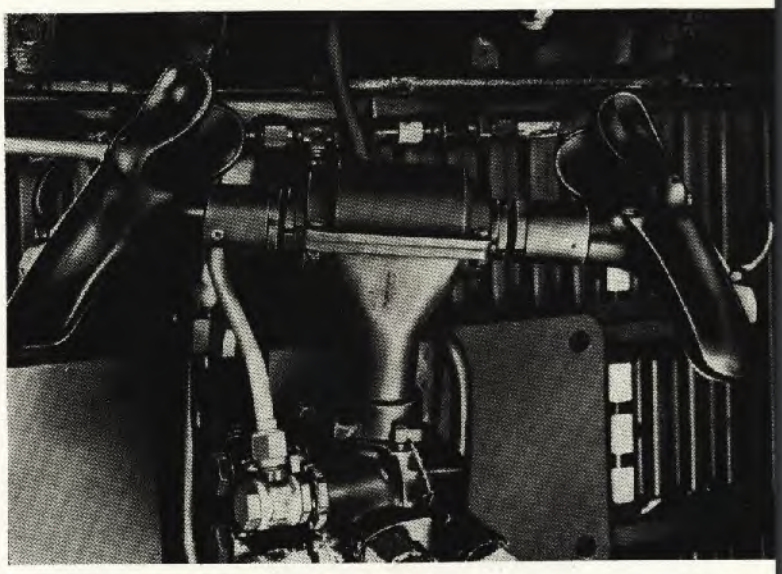
To start the pump motor, use the bottom edges of your hands to press down the two **safety switches.** When the motor is running the handles will automatically go to neutral position. For this reason it is best to press the safety switches down before grasping the hand grips of the control handles. If 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.

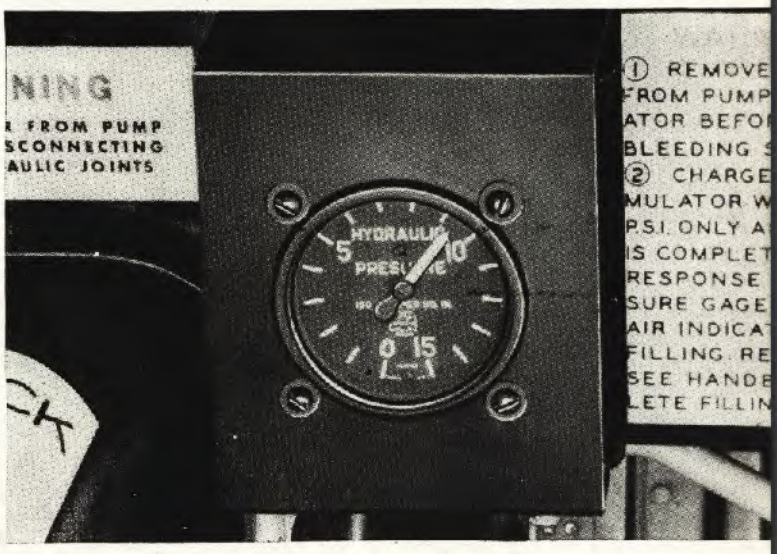
Depressing the safety switches also turns on the **sight** and provides power to the **booster motors** so that they will operate when the guns are fired.

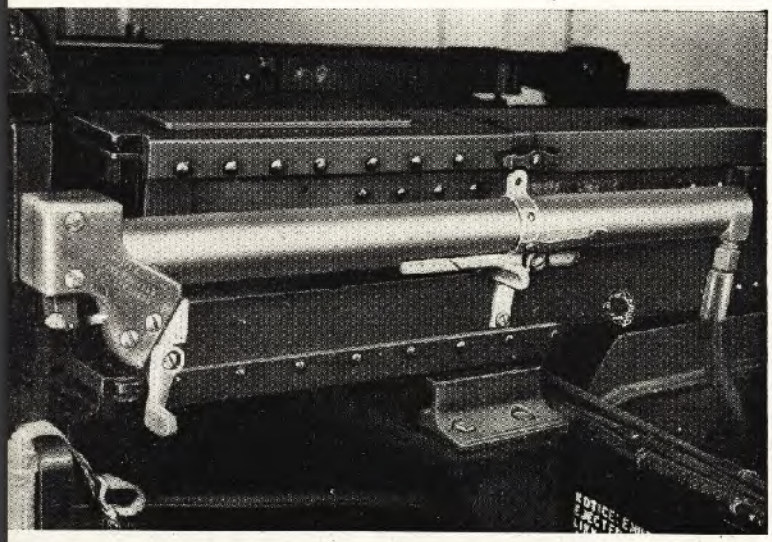
To adjust the brightness of the sight use one hand to hold the control handles, keeping the safety switch depressed, and with the other hand turn the rheostat on the sight.

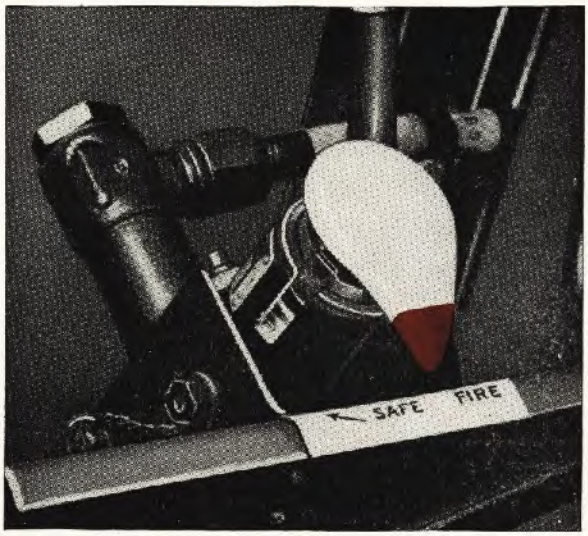
To operate the turret turn the control handles in the direction you desire the turret to move. For azimuth (right or left)—the control handles are operated exactly like those of a bicycle. For elevating the turret move the upper part of the control grips backward; and for depressing the turret move the top portion of the control handles forward. Don't jerk the controls—move them smoothly and deliberately. Right under your index finger on both control handles are the **triggers.** Either trigger can fire both guns.

In front of you on the left is the **high pressure gauge.** As soon as the pump is operating, the









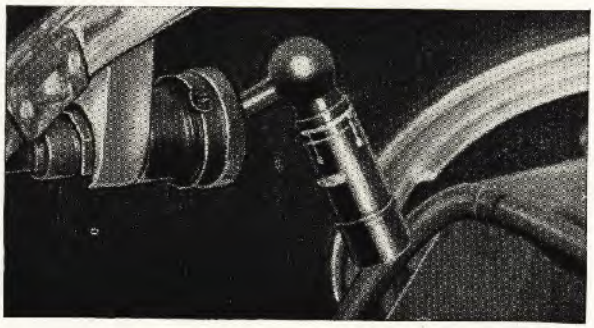
high pressure gauge should register **960** to **1000 lbs.** pressure. While operating the turret, from time to time check this gauge to see that proper pressure is maintained.

Next to your left knee is the **hydraulic gun charger control knob,** which operates the **gun chargers** located on the outboard side of each gun. To charge the guns turn the control knob to the **Fire** position. Depress the control knob sharply. Both guns will be charged at once and ready to fire. If the control knob is turned to the **Safe** position before depressing, the gun bolts will remain in the retracted position which provides access for removing a jam. Remember, the pump motor must be operating before you can charge the guns.

Using Auxiliary Equipment

The **oxygen system** of the turret is completely self-contained. It consists of an oxygen cylinder and a regulator valve mounted on the left seat support and a rebreather mounted to the left side of the ammunition boxes in front of you. A spare cannister is mounted on the left side of the ball structure.

Plug your **heating suit** into the **utility plug outlet** (E) on your control panel and turn on the **utility switch** (F), which is also on the control panel. The **interphone jack box** is located on the top left side of the ball structure. This is where you plug in your interphone jacks for your head set and throat microphone. On the front side of the box is the **push-to-talk** button which enables you to talk with your crew mates.

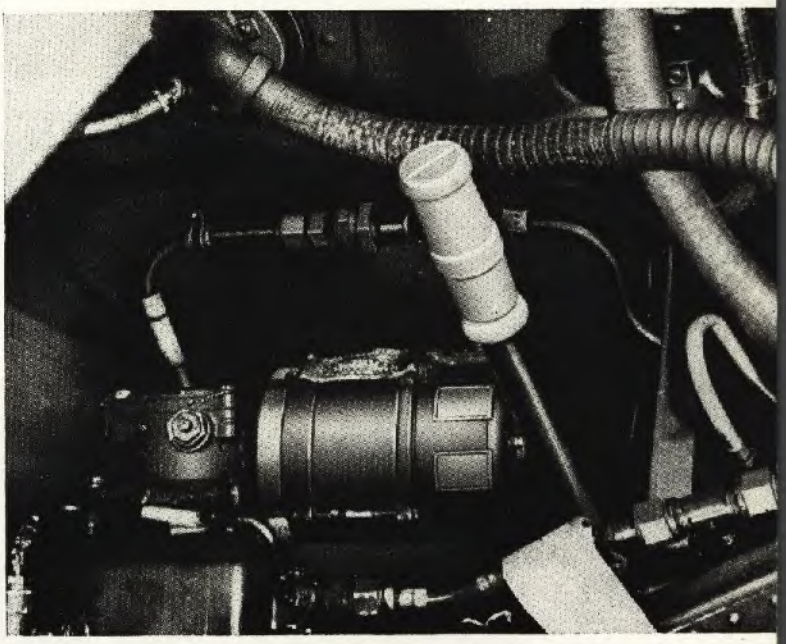


The **trouble spotlight** is mounted on a rib which is part of the plexiglas dome. A ball-swivel joint enables you to direct the light where you desire. The **spotlight switch** (G) is found on the control panel.

Provisions have been made for mounting a **gun camera** below and parallel to the guns just above the ammunition boxes. To put it in

operation, it is necessary to have the **camera switch** (H) and the main power switch in **on** position on the control panel. In addition you must depress either safety switch and either trigger switch.

A hydraulic **emergency hand pump** is provided to operate the turret in case the pump or the electric power fails. For manual operation hold the lefthand grip of the control handles turned in the desired direction and work the hand pump with your right hand. This hand pump will be of great assistance to you in seating the elevation stowing pin and boresighting the guns when a small amount of carefully controlled movement is desired.



Getting Out

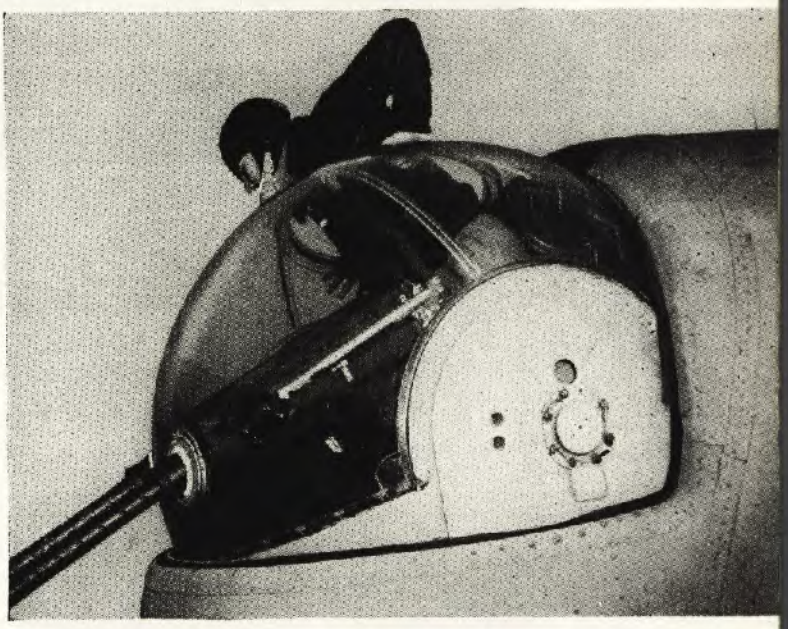
In getting out of the turret before landing, it is of the utmost importance that you pursue the following steps carefully:

Move the turret to stowing position—guns at 0° elevation and 0° azimuth and turn off all switches. With the hand pump rock the turret slightly until you can slip the elevation landing lock pin into position. Then reach down on the lower left-hand side of the ball and turn the azimuth position lock to **on.**

IT IS EXTREMELY NECESSARY THAT THESE LANDING LOCKS BE SECURED. IF THEY ARE NOT, THE TURRET IS LIKELY TO SWING AROUND FREELY IN LANDING, CAUSING DAMAGE TO THE SHIP AND TO ITSELF.

Disconnect all auxiliary units you have been using. Brace yourself against the back of the turret seat rest and lift up on the seat, pushing it back and up, allowing it to follow the seat track until it is in the locked position out of the way.

To get out, all you have to do is grasp the top of the face armor plate and swing down and out of the opening in the bottom of the turret.

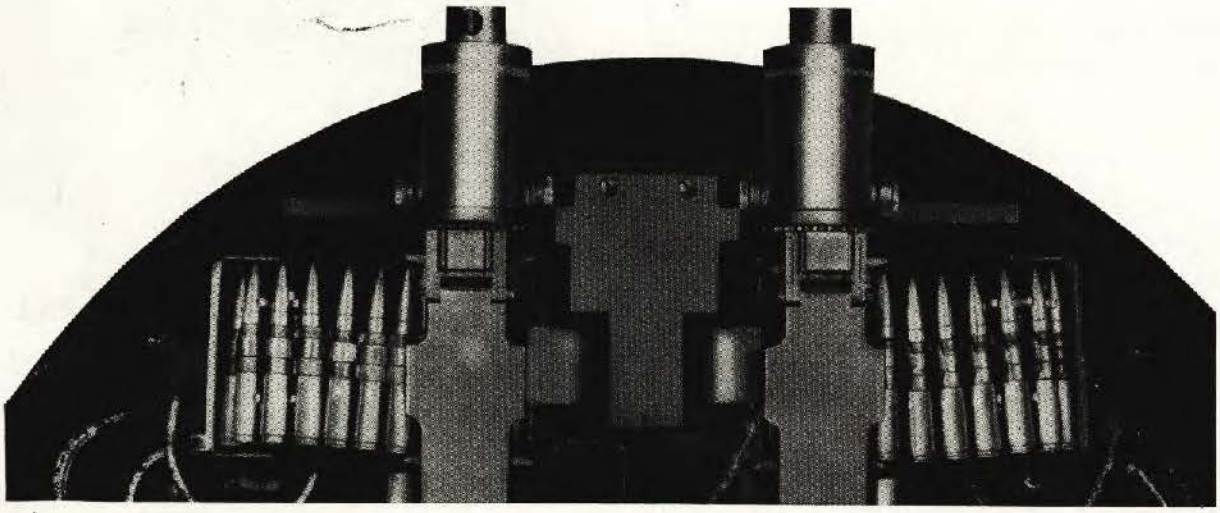


Emergency Exit

It might be possible that you will want to get out of the turret in a hurry. For such an emergency, an escape hatch is provided in the plexiglas dome directly above you. Two plastic handles are located on either side of the hatch, and by turning them a quarter turn the hatch will fall inboard. If you stand on the seat you will find it an easy job to crawl out of the top of the turret.

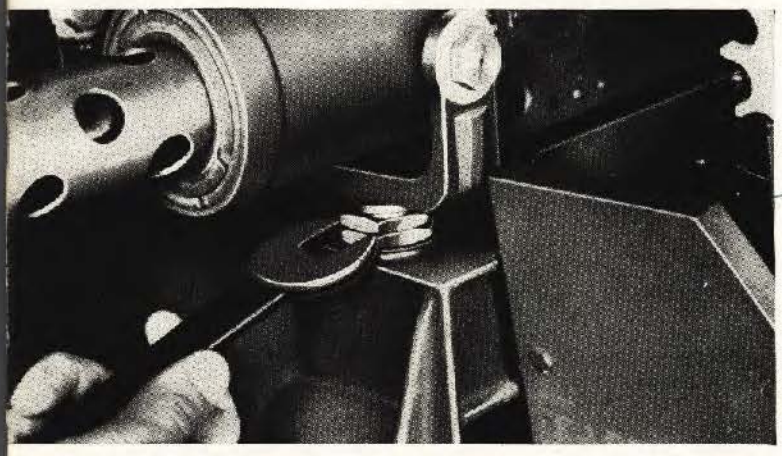
Preparing the Turret for Combat

From the preceding information you now know how to get into the turret, operate it, use its auxiliary equipment, and how to get out. But this is not the entire job which will qualify you as a specialist in the Martin 250SH Turrets. You still have to learn how to adjust the guns and sight, harmonize them, and load ammunition. All this will be found in the following pages.



Adjusting the Guns

In the Martin Ball Turret, two caliber .50 machine guns are mounted to feed from the outboard side. The right hand gun feeds from the right and the left hand gun feeds from the left.



Provisions are made for adjustment of the guns both up and down and sideways. Vertical adjustment is obtained by nuts provided on the front yoke where it attaches to the front mount support. Jam nuts are provided on both top and bottom so that the yoke can be firmly held in position. Azimuth adjustment is obtained by a coupling located directly under the gun at the rear mount. Turning the hexagon-shaped portion of this assembly results in the gun being shifted sideways. Locking is obtained by forcing the jam nuts against the gun frame.

The Sight

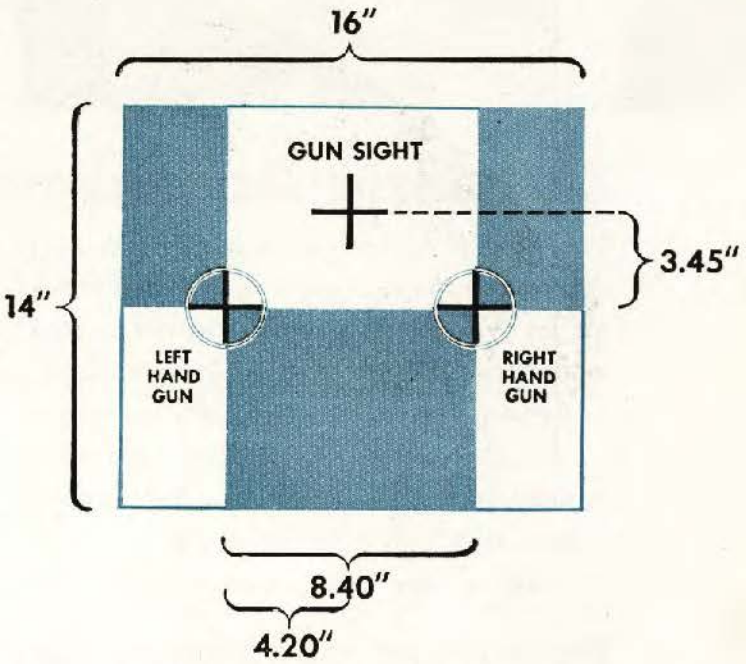
The Navy Mk 9 sight is mounted between the rear gun mount castings in front of the face armor plate. To adjust the sight, as may be sometimes necessary in harmonizing it with the guns, make your adjustments on the sight head. For instructions in making these adjustments see the section on the Mk 9 sight in the general introduction to this section.

Harmonizing the Guns and Sight

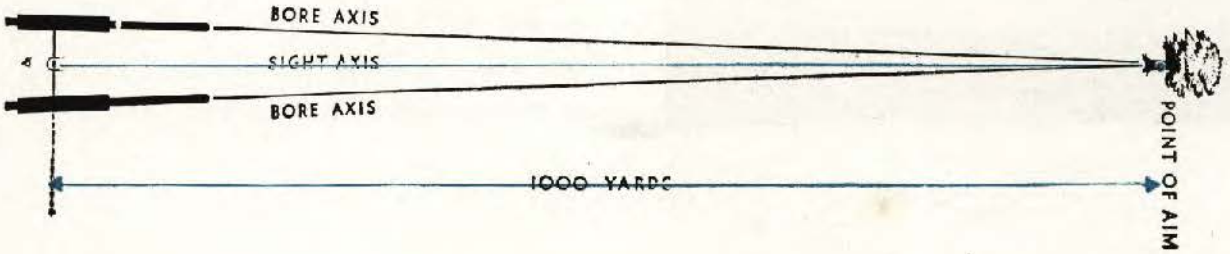
There are a number of ways to harmonize the guns and sight of the Martin Ball Turret. The exact procedure will be defined by the Squadron Gunnery Officer. A handy method is to line up the sight and boresight the guns on some small object, such as a tree or chimney, at least 1,000 yards from your plane. 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. Then line up the sight, using the emergency pump 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 front and rear mount adjustments until the spot the sight is centered on is exactly in the center of each gun bore.

Sometimes the amount of adjustment in the front and rear mounts of the guns may not be sufficient to bring the guns to bear on the object. In that case boresight each gun on the object selected. Then you must make an adjustment 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 above. Set up the stand as level as possible at least 50 yards in front 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.



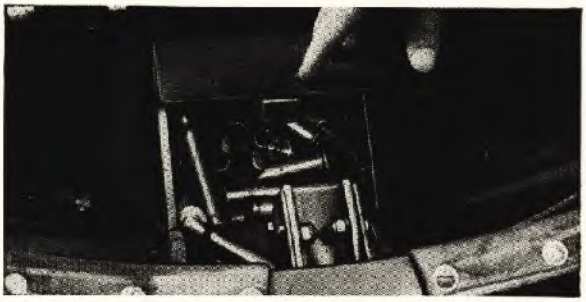
Loading Ammunition

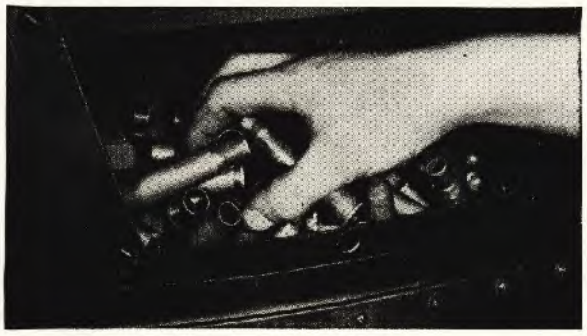
Two built-in ammunition magazines holding 400 rounds for each gun are provided in the Martin Hydraulic Bow Turret. They are located in the forward part of the ball in front of you.

1. Remove the pins that secure the two magazine doors and slide them outboard and aft.
2. Load the ammunition belts by flaking them back and forth in the magazine.
3. Lower a wire hook down through each booster feed into the magazine and attach the hook to the end of the ammunition belt.
4. When the magazines are full, reinstall the doors, pull the loaded belts up through the booster feeds until one or two rounds of ammunition are engaged in the booster sprockets. Lift the gun covers and pull up enough ammunition to be loaded into the guns. Close the gun covers.

Removal of Empty Cartridge Cases and Links

The empty cartridge cases and links are collected in a chamber located in the front part of the turret between the ammunition box and the ball structure. To remove the empty links and cartridge cases release the catch holding the door at the bottom of the ammunition box,





allowing the door to fly up. The empty cartridge cases and links will then drop out in the turret. In older model turrets an access door is provided in the outside lower front of the turret ball. After removing the door and cleaning out the ammunition, be sure to secure door.

Pre-Flight Routine

. . . Follow Step by Step

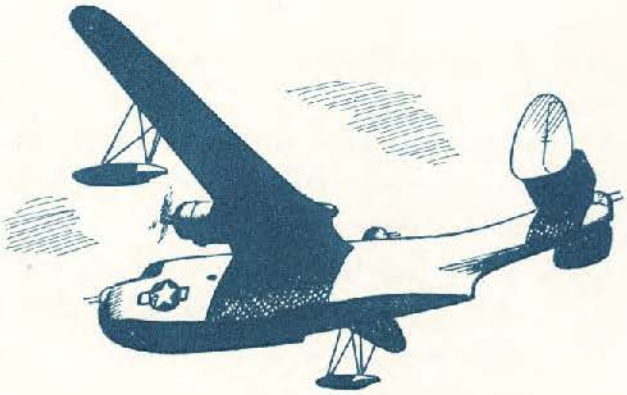
1. Check and reinstall all the mechanisms in both guns so they feed left for left gun and right for right gun.
2. Check harmonization by boresighting on a pattern stand or some other object 1000 or more yards away.
3. Try to rock the guns in mounts to make sure they are securely mounted. Check to see if adjustment and jam nuts are safetied.
4. Inspect hydraulic system and lines carefully. This should be done with and without pump operating. If there are any leaks report them immediately. Check filler valve to see that it is in "run" position and safety wired.
5. With the pump in operation operate your gun charger valve knob in both "safe" and "fire" position.
6. Turn on main power and pump motor switches. Depress safety switches and charge guns. Squeeze either trigger and listen for "click" of firing pins in guns. Test the other trigger by repeating operation.
7. Inspect electrical leads and conduits (Breezes) to determine if they are frayed or damaged.
8. Check all Cannon plugs to see that they are properly seated and screwed up tight.
9. Check oxygen connections to make sure that they are tight.
10. Make sure plexiglas dome and escape hatch are properly secured and clean.
11. Check low pressure gauge to determine that you have the 25 to 30 lbs. pressure required.
12. Operate the turret to determine if pressure gauge reads the 960 to 1000 lbs. pressure required.
13. Check for ease of operation in elevation and azimuth.
14. Stop turret with pump running, (control handles in neutral) and 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 to extreme elevation, depression, and azimuth to determine if the limit stops are functioning properly.
17. Turn on sight and gun switch; depress safety switch, and rotate sight rheostat from dim to bright to adjust the reticle to existing light conditions. Make sure the rheostat is working properly. Try both filaments of the sight bulb. If either are burned out, replace the bulb. Make sure the reflector plate of the sight is clean.
18. Plug in your headphones and microphones to test if your crew mates can hear you and you can hear them.
19. Plug in your heating suit and make sure it begins to heat.
20. Make sure trouble spotlight is operating.
21. Inspect all ammunition belts. See that they are in good condition and properly belted.
22. Check booster motors by tipping them toward the guns. Make sure they cut on and off sharply without lagging.
23. Load ammunition magazines. Feed the double link up over the booster motor sprockets and press the first rounds into the feedway of each gun. You will not charge the guns until you are in the air and so ordered by your plane captain.

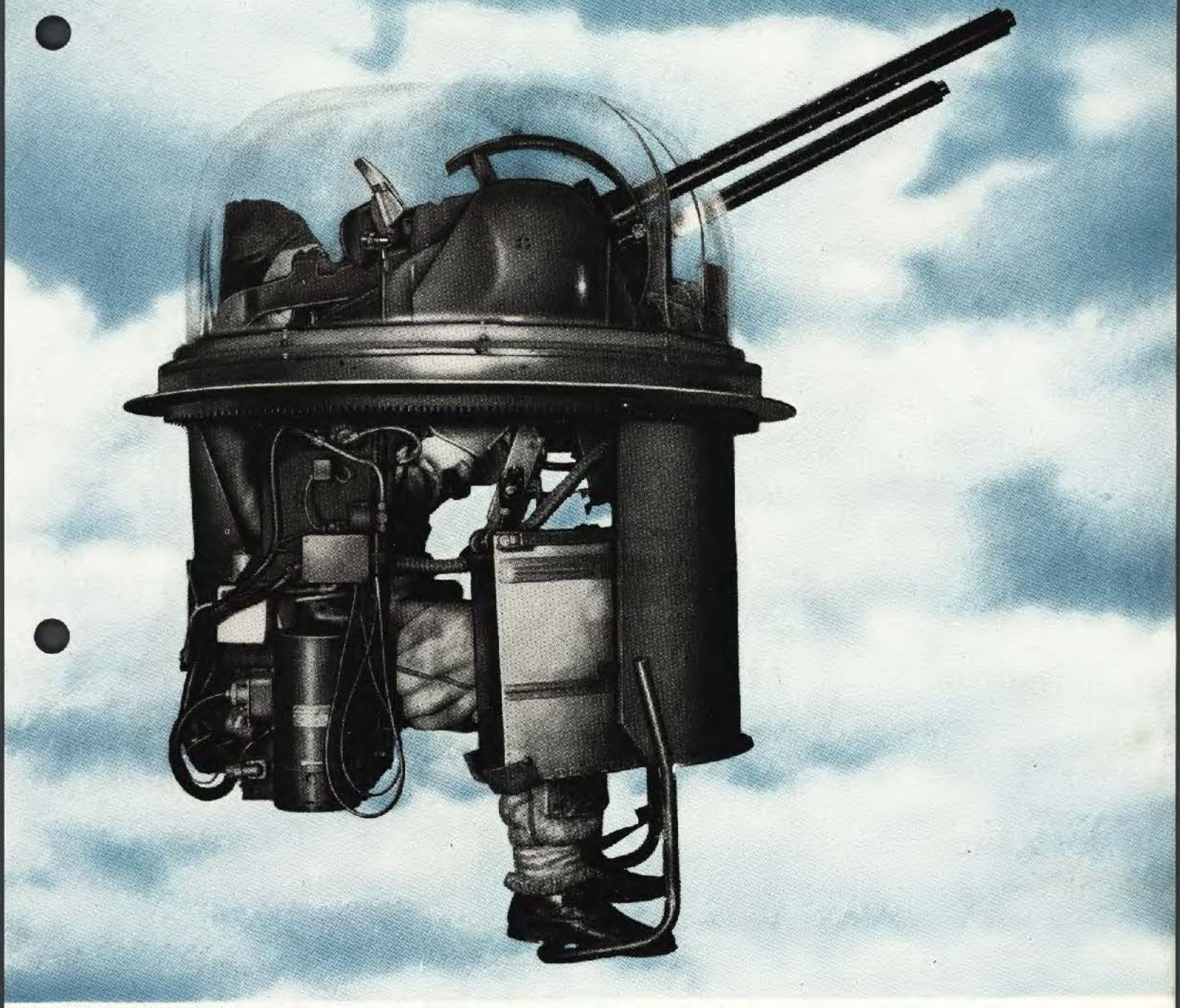
Before Landing

1. Run turret to its stowing position—zero elevation and zero azimuth, guns pointing straight forward.
2. Engage elevation and azimuth landing locks.
3. Clean the guns by lifting gun covers, removing the ammunition, and charging them twice.
4. Remove ammunition from feedways. Check all switches and make sure they are off.
5. Unfasten safety belt and get out of turret.

After Landing

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





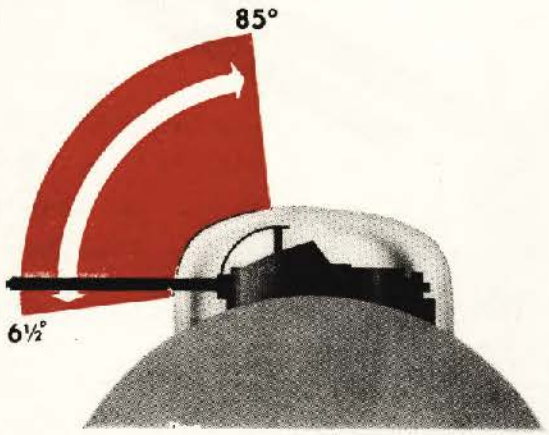
The Martin Electric Upper Deck

MARTIN 250CE-7 through 21

The Martin Electric is one of the most widely used of all turrets. It is designed for quick action and easy operation. It has no gadgets. Everything is made for action and placed where it can be reached quickly when the chips are down.

There are several models. Some of them are improvements over old models, like a new automobile which is better than last year's. Some are simply designed for different kinds of bombers; for example, the model which goes on the PV-1 is not quite the same as the one in the PB4Y-1. But if you can operate one Martin, you can operate them all.

Facts and Figures



ELEVATION

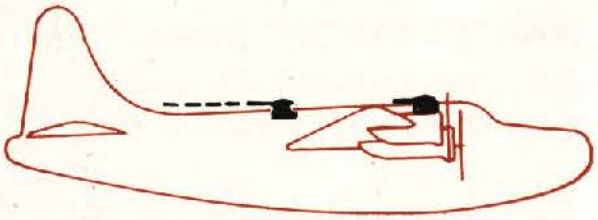
In elevation, the turret guns can be lowered and raised from a little below horizontal (–6½ degrees) to almost straight up (85 degrees).

SPEED

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

ARMOR

Armor plate is ½ inch thick. It protects the gunner in front, no matter where he aims his guns.



POWER

The Martin turret operates on power supplied from the bomber's central electrical system.

SIGHT

The turret is equipped with the standard Navy MK 9 reflector sight, fully described in the Sights and Sighting section of this manual.

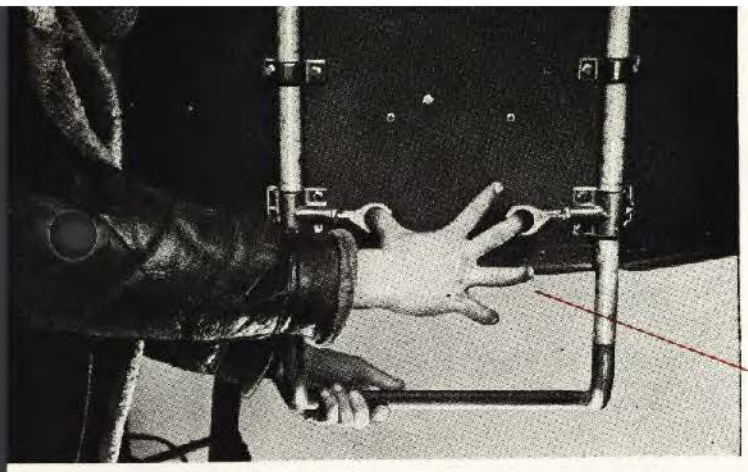
AZIMUTH

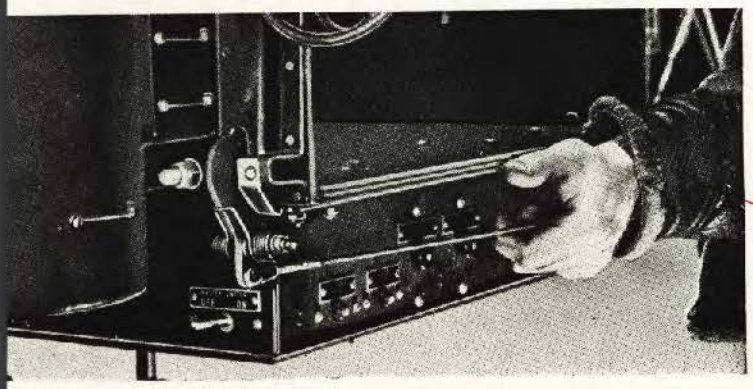
The turret can move 360 degrees—a full circle—in azimuth.

STOWING POSITION

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

Getting In





To start getting acquainted with the Martin Upper, step in. The Martin is easy to get into, simple to operate, and easy to get out of. Only one special precaution is necessary.

First turn on the main power switch—a toggle switch on the fuselage near the turret. Then adjust the footrest to fit your own height. Try it a few times to get the right position.

If you need more room to slip up into the turret, drop the bottom of the seat by pulling on the small cable stretched across the front.

Stoop and squirm up into the middle of the turret, face the front, grasp the two main supports curving about your head, and hoist your body up.

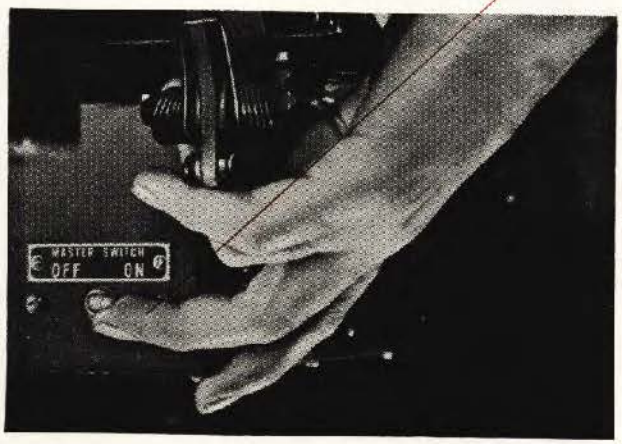
Don't pull yourself up by the sight cradle or the two nearby link rods. Your weight on the cradle may throw off the whole sight adjustment, or bend the link rods and throw the sight out of line with the guns.

Finally, stand on the footrest and brace your body against the back of the seat. If you've dropped the seat, use your heel to draw it up until the latches on each side of the seat click. Sit down. Use spare seat cushions to adjust your height until your eye is level with the sight. Snap on the safety belt—and you are ready to go.

Operating the Turret

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

Close at hand, as you sit in the Martin Upper, are all the clutches, switches, and controls. They are easy to get at and easy to use—a few clicks and the turret is ready to operate. But be sure to engage the clutches and turn on the switches in the order shown here.



1

Make sure the **azimuth clutch** is engaged: the small lever, under the control handles and to the right, must be pushed **Down.** Then make sure the **elevation clutch,** a lever above the control panel and to the left, is pushed in to the engaged position to the **Left.**

2

Reach down on the right side of your seat and turn on the **master switch.** This is like the ignition switch on a car.

Never try to operate without engaging these power clutches. It is like trying to drive your car with the clutch down. You don't get anywhere, and you may wreck the turret.

3

Raise the red plastic cover on the right side of the control panel (opposite page) and flip on the **master gun switch** (A).

4

Turn the **gun selector switch** (B) to **Both Guns.** With the switch in this position, both guns will fire when either trigger is pulled. (In the **Individual Guns** position, each gun is fired only by its own trigger. Use this only when one gun is out of action.)

5

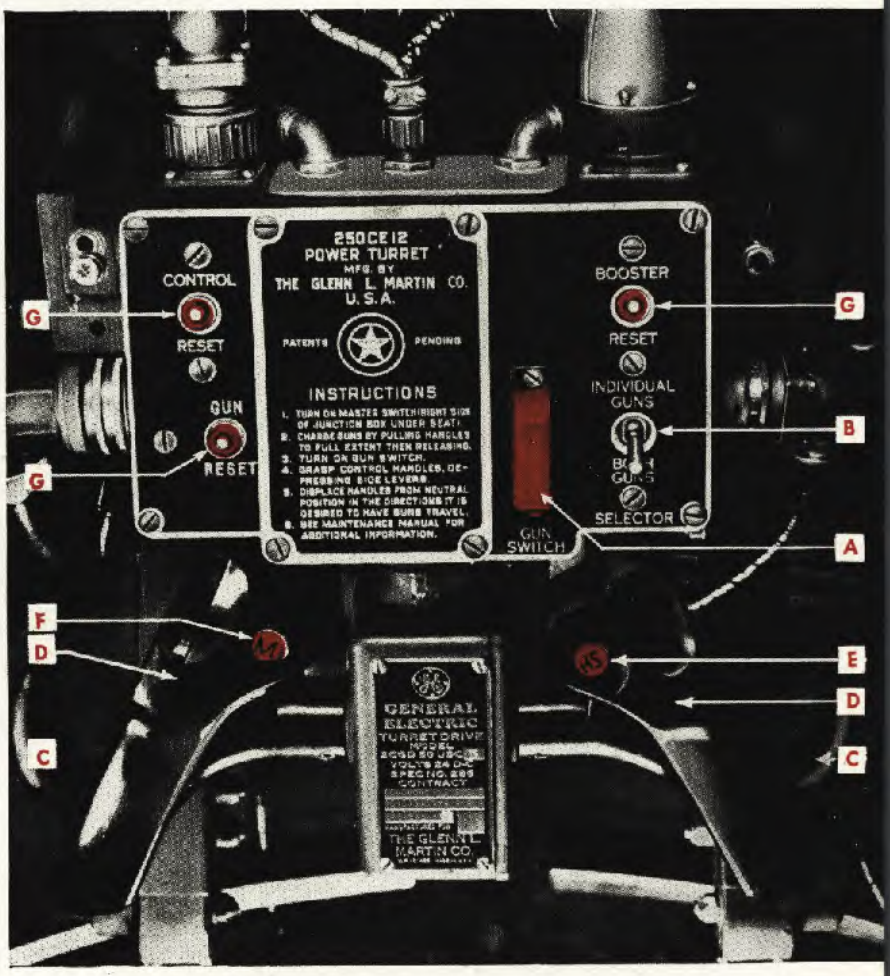
Turn on the **sight switch** on your sight located in a clamp on the face armor plate. To adjust the brightness of the sight reticle to suit lighting conditions, twist the rheostat button from dim to bright.

6

Finally, grasp the control handles so that the bottom edges of your hands depress the two **safety switches** (C). With these switches down, the turret is ready 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 handles to raise the guns. Pull up on them to lower the guns. The slightest movement of your wrists regulates the turning, raising, or lowering.

The other controls you will need in combat are right at your fingertips. Right under your index finger on both handles are the **triggers** (D). On the top of the right control handle, by your thumb, is the **high speed button** (E) that throws the turret into high speed for changing quickly from one target to another. At your left thumb is the **push-to-talk-button** (F) that opens the interphone system for you to speak. On the main control panel are also **reset buttons** (G) for the control unit, and booster motor circuits. Down on the front panel of your seat, behind your legs, are resets for the major electrical circuits—auxiliary power, azimuth, elevation, and firing circuits. Depress these reset buttons in emergencies when your power fails.

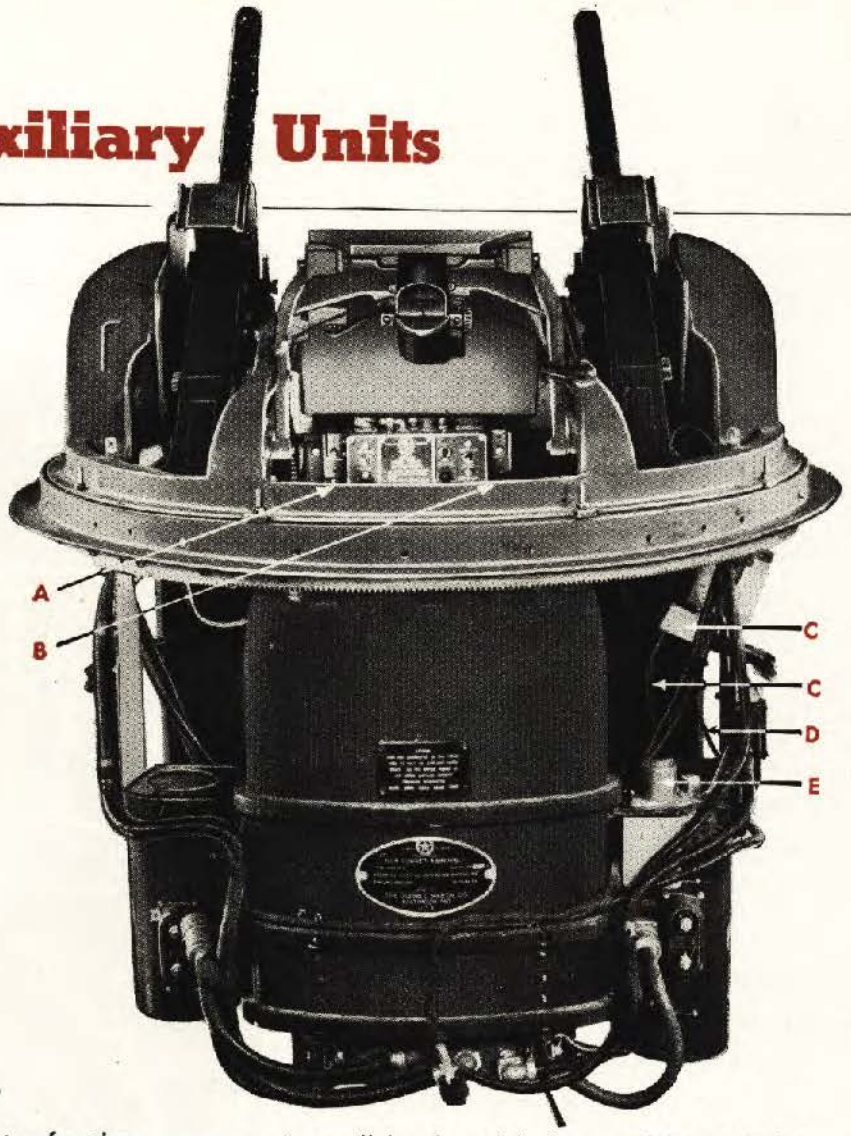


7

To charge your guns, pull cross-arm on the **charger handles** beside your shoulders—grasping the right handle with the left hand, and the left handle with the right hand. Pull them out sharply as far as the charger cables will go. Don't ride the cables on the return action; keep your hold on the handles but allow them to spring back under their own power.

Using the Auxiliary Units

A Elevation and azimuth hand cranks (Below Control Unit)



B Heated suit unit
C Interphone jack box and jacks
D Oxygen regulator and gage (On some turrets, regulator is below control unit, gage on left side)
E Trouble light

You will find a demand type regulator for the oxygen system on your right arm rest—or, in a few Martin turrets, just below the control unit. The oxygen flow and pressure gage is on the left or right, just off your shoulder.

The source of oxygen supply depends on the plane. In the Liberator the supply is contained in two bottles bolted to the bottom of the seat. In the Marauder the supply comes from the plane's central tanks by tubing which enters a swivel joint in the floor below your turret.

In all Martins the heated suit plug-in is above the left arm rest. The interphone jack box is to the right of your right elbow. The trouble light is at the back of the right arm rest, and the gun camera bracket is just to the left of the sight.

Hand cranks for manual operation in emergencies will be found below and behind the control handles: the right crank for azimuth movement, the left crank for elevation. A trigger switch in the handle of the right crank fires both guns. (Some late models have a foot-firing pedal mounted on the left side of the footrest.)

To change to the manual system: 1) Shut off the turret's master power switch. 2) Engage each crank handle by pulling it from its catch. 3) Hold on to the azimuth handle while disengaging the azimuth power clutch, then to the elevation handle while disengaging the elevation power clutch.

Before going back to power operation, be sure the cranks are disengaged and hooked back up on their catches. If you leave them engaged, they will whirl around and may break your leg.

Getting Out

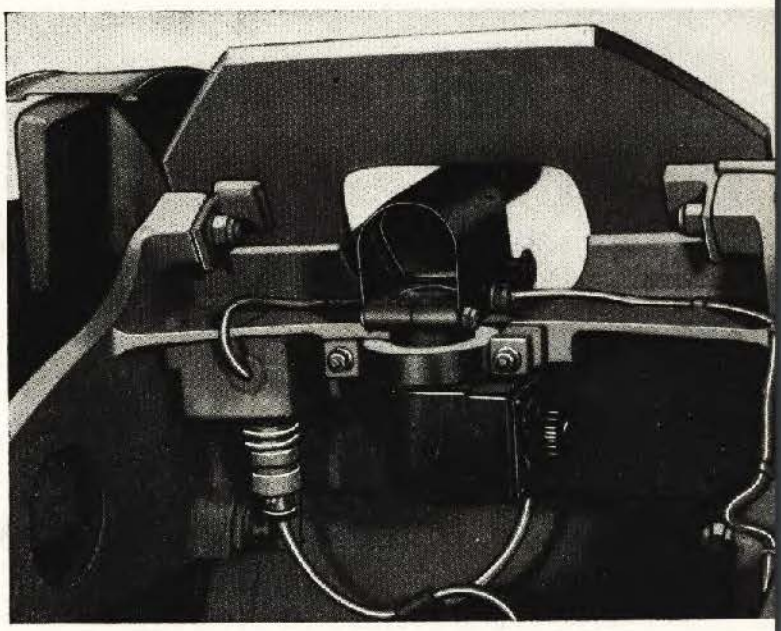
Before leaving the turret, move it to stowing position—guns pointing straight back on the tail. Then turn off all the switches. Make sure the azimuth and elevation power clutches are **engaged.** Disconnect any auxiliary units you have been using. Then brace yourself against the back of the seat and ease your body out of the turret. Drop the seat, if you wish, by pulling its cable.

Preparing the Turret For Combat

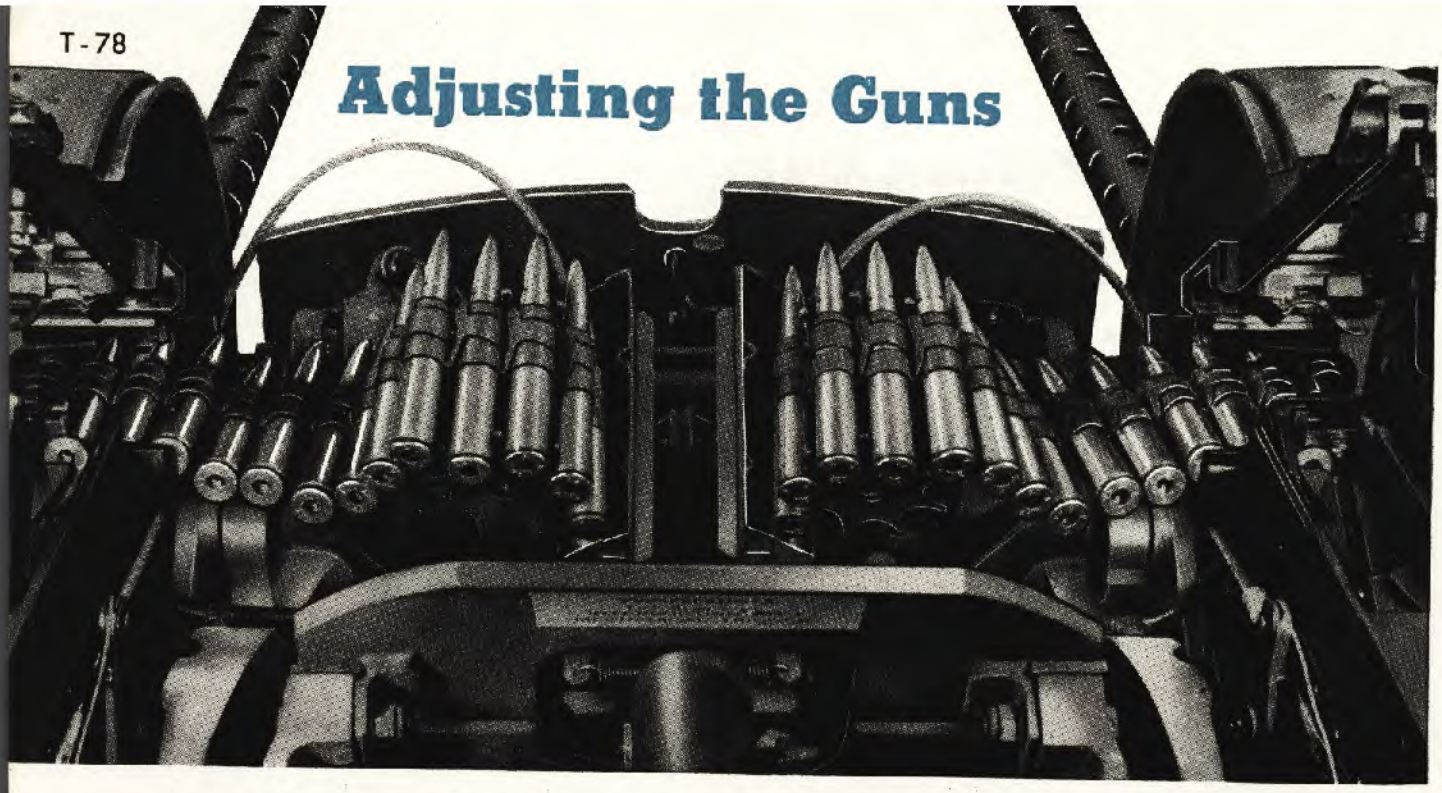
With the practical, working information contained in the preceding pages, you could easily take over and operate the Martin in combat. If you specialize in the Martin, however, that will be only part of your job. The rest of your job—adjusting your sight and guns, and loading the ammunition for a mission—is explained in the following pages.

Adjusting the Sight

The Navy Mark 9 sight fits into the gun sight bracket directly behind a ½" face 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 in making these adjustments see the section on the MK 9 sight in the general introduction.



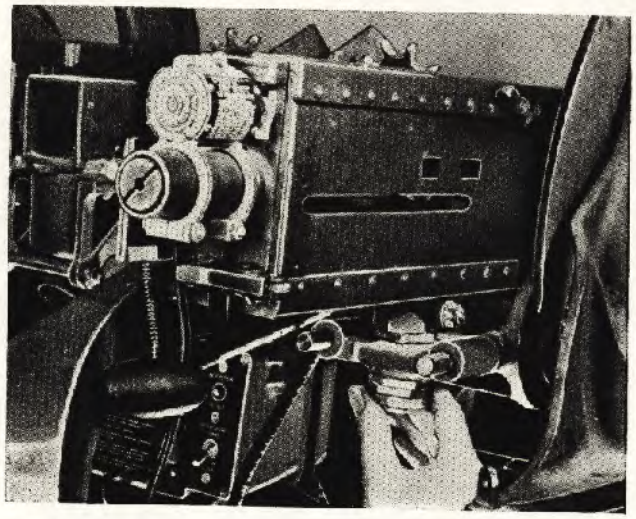
Adjusting the Guns



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

The guns are bolted into front and rear mounts in the gun cradles; the two mounting bolts on each gun must have cotter pins. Special charging units are installed on the inside plates of the guns; their mounting bolts must be safety wired. Special ejection chutes are installed on the outside of the guns to carry links away.

The guns may be adjusted up, down, or sideways in their cradles by means of a lock and adjustment nut unit on each rear gun mount.



To make adjustments on either gun:

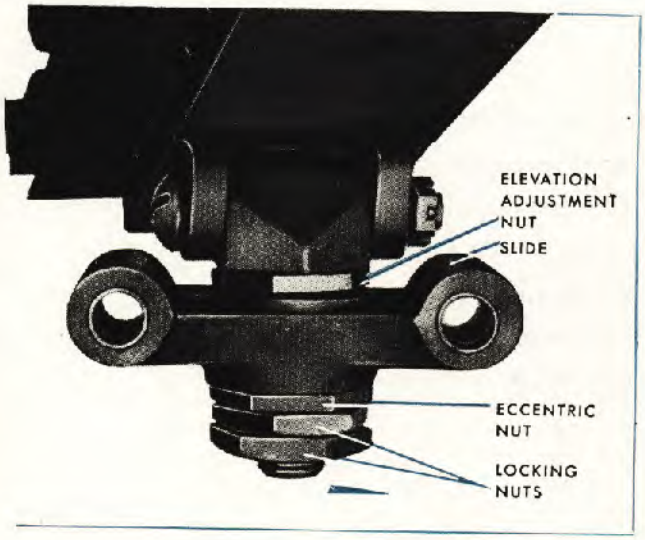
1 Loosen the two bottom lock nuts.

2 Turn the elevation adjustment nut left or right to raise or lower the back of the gun.

3 Turn the eccentric nut left or right to move the back of the gun from side to side.

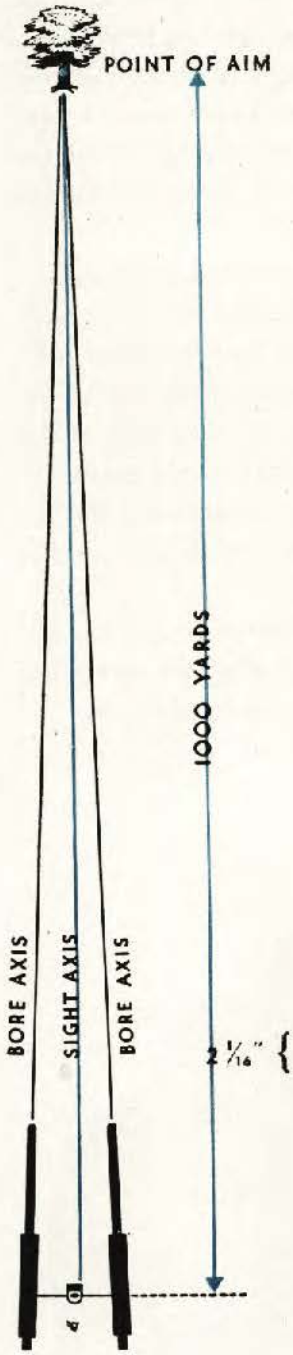
4 Tighten and safety wire the lock nuts.

By means of these adjustments the guns can be centered in their mounts. Turn the elevation nut until there is a space of about 3/32 inch between the nut and the slide. Then turn the eccentric nut until the thinnest side of its wall faces toward the rear—a mark on the edge of the nut will tell you which is the thinnest side.



Harmonizing
the Guns and Sight

There are a number of ways to harmonize the guns and sight in the Martin 250CE 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 your plane. Remove the backplates 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.

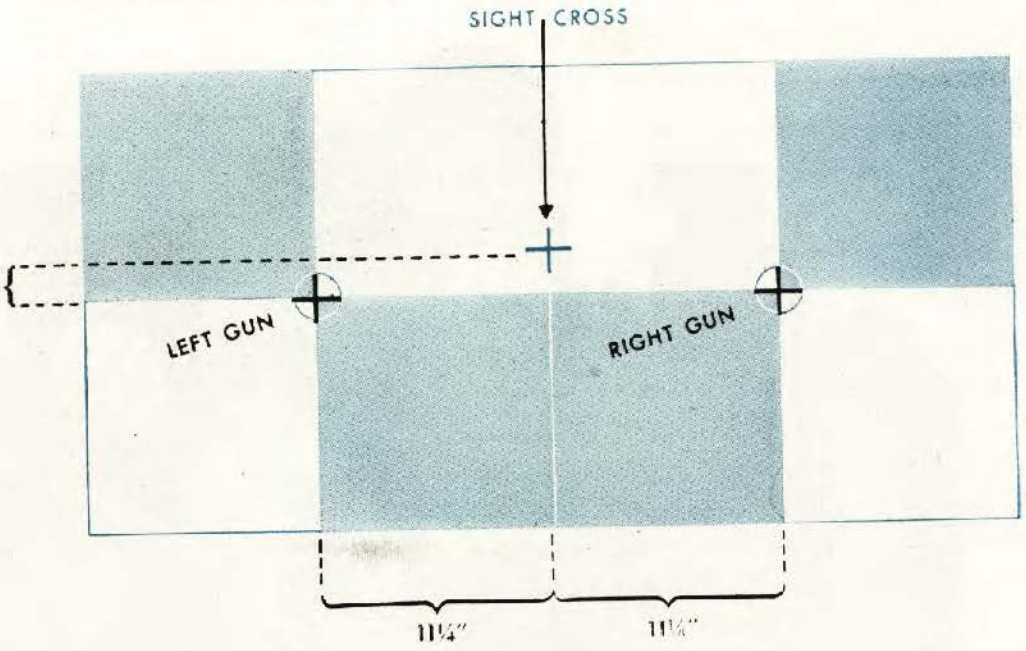


Now line up the sight, using the hand cranks to move the turret until the dot of the sight is squarely on the object. Don't move the turret again. Then boresight through each gun barrel to line up each gun. Adjust each gun by its rear mount adjustment nuts until the spot the sight is centered on is exactly 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.



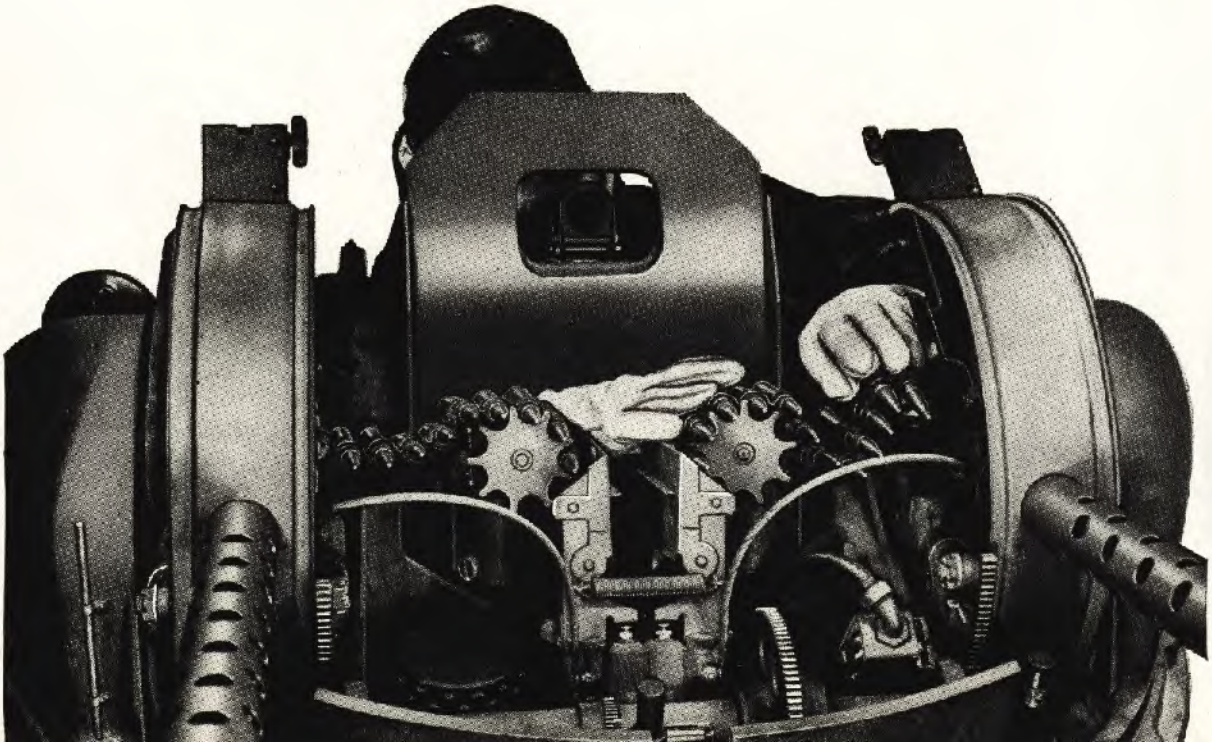
Loading Ammunition

The Martin carries four ammunition cans, holding about 200 rounds each. When you fold in the ammunition belts, load two cans for the right-hand feed gun by starting with the single-link end at the right edge of the can; the double-link end will then come out the left side of the can at the top. Load the other two cans for the left-hand feed gun just the opposite.

← The ammunition cans ride on a semi-circular track beneath the guns. Each is held in place by two rollers and a strip which fits into a groove in the track. When you put the cans into the turret, be sure both rollers are in the tracks and the strip is securely in the groove. Load the two right-hand cans into the right track, the left-hand cans into the left track. Push the cans all the way in, so that the automatic latches catch in slots in the cans.

↓ To feed the ammunition belts over the booster motors which help lift them into the guns, you must have two extra 35-round lengths of belt to use as feed strips. Open the hinged sections at the top of the booster chutes. Down each chute drop one of the feed strips — single-link end first — until there are about 10 rounds left between the boosters and the guns. Make sure the rounds rest evenly in the sprocket wheels.

The double-link end of each feed strip goes into the guns' feedways. The single-link ends are connected to the belts in the two inside ammunition cans.



Pre-Flight Routine

. . . follow step by step

1. Install the barrel and oil buffer groups in the guns—leaving out the bolts and backplates.
2. Check harmonization by boresighting the guns on some small object at least 1,000 yards away or on a template.
3. While you are harmonizing the guns, make sure the manual system of operation is working properly.
4. Still using the manual system, check operation of the mechanical limit stops which keep your guns from bumping against the fuselage when pointed toward the side.
5. Make sure the bolts are assembled properly, to feed from the right on the left gun and from the left on the right gun. Then install the bolts and slide the backplates on both guns.
6. Inspect the ammunition belts to make sure the rounds are in good condition and properly belted.
7. Load the ammunition cans and place them in the turret tracks. Make sure the automatic latches lock them in place.
8. Inspect the electrical cables. Make sure all Cannon plug connections are tight. Report any frayed or damaged cables.
9. Check the oxygen and interphone connections. In some planes this means checking connections to oxygen bottles attached to the seat, and long interphone leads from the wall of the plane. In other bombers it means checking the swivel joint through which both oxygen and interphone lines enter from the floor. Watch for loose connections or failure to swivel.
10. Try to push the turret around by hand to make sure the azimuth clutch is properly engaged. If the turret moves easily the clutch is not properly engaged; push its lever all the way down.
11. Turn on the main power switch. Adjust the footrest and get into the turret. Pull the seat up into place, making sure that both latches on each side catch.
12. Try to push the guns up and down by hand to make sure the elevation clutch is properly engaged. If the guns move easily the clutch is not in place; push its lever all the way to the left.
13. At the same time make sure the gun mounts are secure—you should not be able to rock the guns in their cradles. Make sure cotter pins have been installed in the front and rear mounting bolts.
14. On the charging units, make sure all three nuts on each charger plate have been safety wired. Make sure the charging cables have been properly attached to their levers.
15. Make sure the dome is clean.
16. Turn on the master switch.
17. Turn on the sight rheostat and turn it from dim to bright to adjust the brightness of light in your sight and to make sure it is working properly. Try both filaments of the sight bulb; if either is burned out, replace the bulb. Make sure the optic head is clean.
18. Turn on the master gun switch.
19. Flip the gun selector switch to Individual Guns. Charge the guns by pulling cross-arm on the gun charger cables. Check the guns' headspace. Then pull one trigger at a time and check the electric triggers for adjust-

ment—listen for a "click" as the firing pin of the gun releases. Then turn switch to Both Guns and make sure both guns fire properly from either trigger.

20. Test the booster motors by tilting the boosters toward the guns. Make sure the motors cut on and off sharply without lag.
21. 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 operates with either safety switch held down. Test the limit stops which cut off the turret power to prevent the guns from striking the fuselage when pointed forward or backward. Then stop the turret and check for creep.
22. Check the fire cutoff system by swinging the turret and guns to the tail section of your bomber and attempting to fire. Make sure the guns cut off with the proper amount of margin—your crew chief will tell you how much.
23. Put on your oxygen mask, connect it, and make sure you are getting a flow of oxygen. Check the gage to make sure there is proper pressure in the tanks, as determined by your crew chief.
24. Plug in your headphones and microphone, to test whether your crew mates can hear you and you can hear them.
25. Plug in and test your heated suit and the rheostat.
26. Make sure your trouble light operates. Flip the switch to make sure the bulb lights. Pull the light out on its cord to make sure the retractable reel is working properly.
27. Turn off all switches. Drop two 35-round feed strips of ammunition down the booster chutes, leaving about 10 rounds extending from the booster sprocket wheels to the guns. Make sure the rounds rest evenly in the sprockets. Connect the feed strips to the belts in the inner cans, making sure the connecting rounds are pushed in evenly.
28. Make a last visual check of the whole turret, inside and out.
29. Just before the takeoff, push the first rounds of ammunition into the guns' feedways over the belt holding pawl. In flight, charge both guns on order of the flight commander.

Post-Flight

1. Run the turret to its stowing position—guns pointing straight back toward the tail. Make sure both power clutches are still in their engaged position.
2. Remove the ammunition belts from the feedways.
3. Clear the guns by opening the gun covers and hand charging them twice.
4. Take the ammunition cans out of the turret.
5. Field strip the guns.
6. Clean up all brass and links around the deck near the turret.
7. Clean the gun casing groups, thoroughly inspecting the condition of their parts — as described in the post-flight check in the Guns section of this manual.
8. Then detail strip the parts you have removed from the guns, cleaning them and making a thorough check on their condition—also described under the post-flight check in the Guns section.
9. Report any malfunctions of turret or guns noted on the mission.