EQUIPMENT OPERATION

IN describing the operation of the equipment space does not permit complete instructions for the various types of equipment in use in the merchant marine. The description contained herein will apply to the Mark XIV Mod. 1 Compass, but in general the same instructions cover all other types; if a general understanding of what is necessary is acquired the operator will have no difficulty in carrying out the detailed operations of starting and stopping any equipment even though the steps may differ in a few respects from those outlined here.

NOTE: The Mk. XIV-1 Compass is the type which is installed in all the new ships built since 1937. Previous to 1937 the Mark VIII compass was used.

Preparing to Start

It is preferable to start the equipment at least 4 hours before the compass is required for service. This is to allow sufficient time for it to come up to running temperature and settle on the meridian.

Make certain that all supply switches are open.

Unlock binnacle top cover, open one door and make sure that vertical ring and rotor-case locks are applied.

Take hold of both sides of phantom and vertical rings and turn them slowly until compass card indicates approximate heading of ship. The Compass should never be turned in azimuth, with the power off, by pressure on compensator weights or mercury ballistic.

Check height of oil in oil-well windows. Make sure that oil level is just even with *center of dot* on window and that oil level is the same on both sides of Compass.

Test alarm by throwing switch on alarm unit for a second or so, to make sure relay functions.

Adjust speed and latitude correctors to proper setting.

Starting the Master Compass

Pull out circuit breaker plunger on control panel, to energize motor-generator. Hold plunger out by hand until motor-generator speeds up (in about 5 seconds).

If compass rotor does not start with motor-generator, rock compass in plane of its rotor until it starts.

When starting alongside a dock, wait until rotor is up to speed (approximately 15 minutes), then turn on follow-up switch on amplifier panel. (When starting up at sea, release the rotor case and vertical ring locking latches immediately and steady the rotor case by hand until rotor is up to speed.)

Wait one minute for rectifier tube filaments to heat up.

Release rotor case and vertical ring locking latches.

Turn ON azimuth motor switch at amplifier panel.

Turn ON repeater switch at control panel.

Turn switch at alarm unit so as to silence alarm.

Reset Compass on ship's heading by pressing down on one or the other of the rotor-case bearing housings, and if necessary level the rotor by pressing against the vertical ring until bubble is in normal settled position. Check repeaters, and synchronize if necessary.

When the rotor-case is unlocked the bubble should be brought to its settling position. The compass will then settle on the meridian without further assistance from the operator. The settling time may be greatly reduced, however, by setting

the compass on the approximate heading before starting.

Setting Compass on Meridian When Ship's Heading is Known

After compass is up to speed and operating normally, precess compass by pressing on top of the proper rotor-case bearing housing until the compass card indicates the heading of the ship. Then level the case by bringing bubble to normal settled position. The compass is now within a degree or two of the meridian and will settle on the meridian rapidly.

Setting Compass on Meridian When Direction of North is Unknown

1. Set the speed and latitude correctors. This can be done while the compass is coming up to speed.

2. As soon as the compass is up to speed (about fifteen minutes after it is started) release rotor case and vertical ring locking latches.

3. Level the rotor-case by pressing against the side of the vertical ring. If normal settling position of the bubble in the spirit level is known, bring bubble to this point rather than the center of the level.

4. Note number of divisions bubble moves in one minute. Number of divisions multiplied by 10 equals approximate displacement in degrees from North.

5. Apply downward pressure on rotor bearing housing away from which bubble moved until compass is precessed number of degrees computed.

6. Level rotor-case again and repeat this operation. The compass will then be within a degree or two of the meridian.

7. If the compass happens to be 180 degrees away from north, the second check will indicate a greater correction than the first. If this happens, run a third check, and if the bubble travel is greater than it was in the second you will know that the compass was started approximately 180 degrees away from North. Precess the compass 150 degrees in the same direction as the previous corrections and make two additional checks, which should bring the compass approximately on the meridian.

8. An hour later note the position of the bubble and record for future reference as the settling point for that particular latitude. The compass can be set on the meridian more accurately by starting the bubble from this point than by starting it from the center of the level.

NOTE: As explained under "Operating Principles" the axle of the gyro-compass is horizontal only at the equator. As the compass is moved away from the equator, the vertical component of the earth's rotation begins to take effect. In northern latitudes the north end of the gyro tends to rise and turn to the east. Therefore it must be precessed faster toward the west as the latitude increases. This is accomplished automatically by a slight tilt of the rotor-case and ballistic, which causes a greater amount of mercury to accumulate in the south mercury containers than in the north. The amount of tilt increases with the latitude, the bubble travel being in the direction the ship is moving, north or south. The bubble travel is approximately one division on the level for each 20 degrees of latitude change.

Setting the Speed Corrector

When the compass is in operation, the corrector should be set for the approximate speed and latitude of the ship. These settings need not be changed for small variations in speed and latitude, but should be kept within 3 knots and 3° respectively.

To set corrector, turn knob until the scale line corresponding to the ship's latitude on the movable latitude bar intersects the curve representing the ship's speed on the speed plate across which the latitude bar is movable.

Setting the Latitude Corrector

To set the latitude corrector, turn knob until line engraved on lubber ring coincides with approximate local latitude marked on adjustable block of corrector.

If Alarm Sounds During Normal Compass Operation

A momentary failure of the supply current will cause buzzer to sound until the supply is restored, and in such case the accuracy of the compass will not be affected. It is well, however, to check repeaters with Master Compass after any momentary failure of the supply.

If alarm continues to sound, the current failure evidently is more than temporary. Turn switch OFF to silence buzzer. Examine control panel immediately. The circuit breaker is adjusted to open approximately 5 seconds after ship's supply fails. If, on examination, the circuit breaker is found open, repeat instructions for starting compass at sea. Check Master Compass and repeaters.

Stopping Compass

Turn alarm switch to silence buzzer.
Turn OFF azimuth motor switch.
Turn OFF follow-up switch.
Turn OFF repeater switch.

Depress push button on control panel until circuit breaker snaps open; the voltmeter pointer will then return to 0.

If stopping compass at sea, during heavy weather when considerable motion is imparted to the compass, steady rotor by hand until it stops, then lock it with locking latches. If stopping at dock, there is no need of supporting rotor by hand; it may be locked immediately.

Inspect equipment and clean same, if convenient. The equipment can best be cleaned while it is still warm.

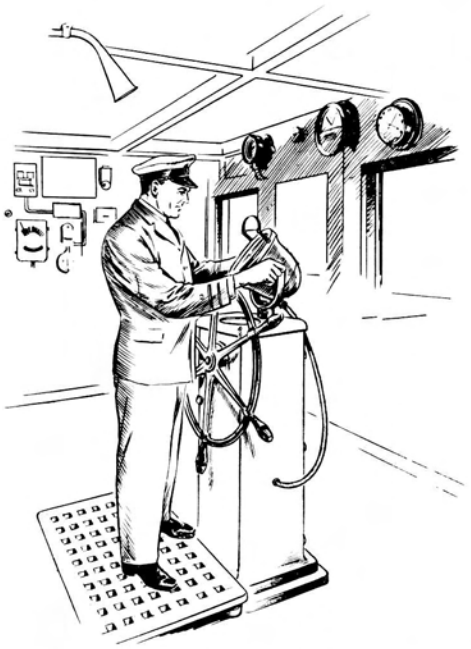
Whether the compass should be stopped at the completion of a voyage depends upon how long the vessel is expected to remain in port. If the time in port is only a matter of hours, it is often expedient to leave the compass running. If it is a matter of days, it is better to shut the compass down. On the Great Lakes, where cargoes may be loaded or discharged in three or four hours, gyrocompasses are sometimes kept running during the full navigation season of six or seven months without a shut down.

Notes:

Under normal operation, the rotor case is uncomfortably hot to the bare hand. This should occasion no alarm, as the normal operating temperature is approximately 45° C. (113° F.) higher than room temperature. Keep oil level even with center of dot in oil-well windows at each end of rotor case.

When setting the compass on the meridian be very careful not to disarrange the three-phase supply leads to the gyro. These leads are loosely coiled where they pass between the vertical ring and the rotor case. Any interference with their position will affect the settling position of the compass.

Never attempt to set the compass on the meridian by pushing on the compass card. The proper way to do it when the compass is not running is to grasp the phantom and vertical ring together and turn the compass until the card indicates the heading of the ship. When the compass is running, it should be precessed to the exact heading by pressing down on one or the other of the rotor-case bearing housings, and



levelled by pressing against the vertical ring until the bubble in the spirit level is in its normal settled position.

Keep binnacle doors closed and cover locked whenever the compass is left unattended. Allow no unauthorized person to tamper with it at any time.

Setting the Repeaters

No harm is done by turning the repeater synchronizer knob when the repeaters are energized. The torque of the motor makes turning difficult, however, and for this reason it is recommended that all of the repeaters be synchronized as closely as possible with the master compass *before* the repeater switch is closed. The telephone set or voice tube between the wheelhouse and the master compass is used as an aid in obtaining accurate synchronization of the repeaters and the course recorder with the master.

As a rule, the manufacturers of radio direction-finders provide an extension to the setting shaft so that the direction-finder repeater may be set conveniently from the outside. Otherwise it is necessary to open the direction-finder binnacle and reach inside to turn the synchronizing knob on the side of the repeater.

When synchronizing the course recorder, turn the synchronizing stem on the end of the motor shaft. To save time, close course recorder cover momentarily and note position of indicator dial relative to heading desired. Then turn stem to bring indicator dial to heading by shortest route. With left-hand pen (zone pen) in proper quadrant, right-hand pen (course pen) can be brought quickly to the required course line on the chart.

CAUTION: Never attempt to synchronize the pens in any other manner than by the synchronizing stem. Application of force to the cam drum, the indicator dial or the pen arms will only result in damage to the instrument.

Keep the course recorder closed and locked except when starting, stopping or making notes on the chart.

GYRO-PILOT OPERATION

Condensed instructions for the use of the particular type of Gyro-Pilot installed are contained on a framed chart in the wheelhouse. The instructions which follow apply specifically to the type of two-unit Gyro-Pilot now being manufactured.

As heretofore mentioned, the Two-Unit Gyro-Pilot provides for steering control by means of (a) the wheel on the steering stand, and (b) automatic follow-up action in conjunction with the Master Gyro-Compass.

Wheel Steering (Follow-Up Control)

Put the control lever on the steering stand at OFF.

At the motor control panel throw the D-C ship's supply switch ON.

Center the wheel pointer.

If the ship has a telemotor, open the bridge by-pass valve to allow the oil to circulate freely through the pipes.

Shift the control lever on the steering stand to HAND.

Steer by means of the gyro-pilot wheel.

Automatic Steering

Steady ship on course with the wheel, as in the preceding directions.

Put rudder amidship.

Move control lever to GYRO.

Set weather and rudder adjustments on Gyro-Pilot to meet sea conditions. (These are seldom altered after their best position is determined.)

To alter course less than 10°, turn pilot wheel in desired direction and steady ship on new course. One wheel turn equals 3° course change.

To alter course more than 10°, move control lever to HAND. Turn pilot wheel in desired direction and steady ship on new course. Put rudder amidship and return control lever to GYRO.

Telemotor Steering

If it is desired to steer by means of the ship's telemotor system, move the control lever on the gyro-pilot steering stand to OFF, thus disengaging the magnetic clutch in the steering engine room, and close the by-pass valve to the telemotor.

Trick Wheel Steering

Provision is made for emergency steering at the trick wheel in the steering engine room. This is done by pulling the pin connecting the Sperry power unit to the engine valve and inserting the same pin in the trick wheel linkage.

Adjustments

The purpose of the weather and rudder adjustments is described fully in the previous section on the Gyro-Pilot; in general, remember that changing conditions at sea necessitate alterations in the steering characteristics of the Gyro-Pilot, just as a human helmsman must vary the amount of rudder used to meet changes in wind and weather. Such changes are met by manipulation of the weather knob and the rudder knob.

Weather Adjustment

In good weather, set knob at 0. In a quartering sea, advance knob just enough to prevent rudder from running back and forth at every roll of the ship.

Rudder Adjustment

With ship light, set knob between 0 and 1. With ship loaded set between 1 and 3. These values are only indicative; experience will determine proper settings under different conditions.

Abnormal Operation

Excessive Compass "Hunt"

If Master Compass is "hunting" excessively, causing the automatic steering system to operate continuously, reduce the "hunt" at the Master Compass by turning the lost motion adjusting knob on the compass transmitter.

NOTE: The latest Mk. XIV Compasses are non-hunting.

The most accurate steering is obtained when the lost motion hammer of the compass transmitter just strikes the stop at each stroke, without causing the roller brushes to move unless there is movement of the ship's head.

Falling Off Course

A sharp change in wind direction or strength will sometimes cause the ship to fall off slightly one or two degrees from the set course. In this event, turn pilot-wheel slightly to compensate for the changed conditions.