

# STAR CLOCK

by John H. BLYTHE

United States Navy Hydrographic Office

---

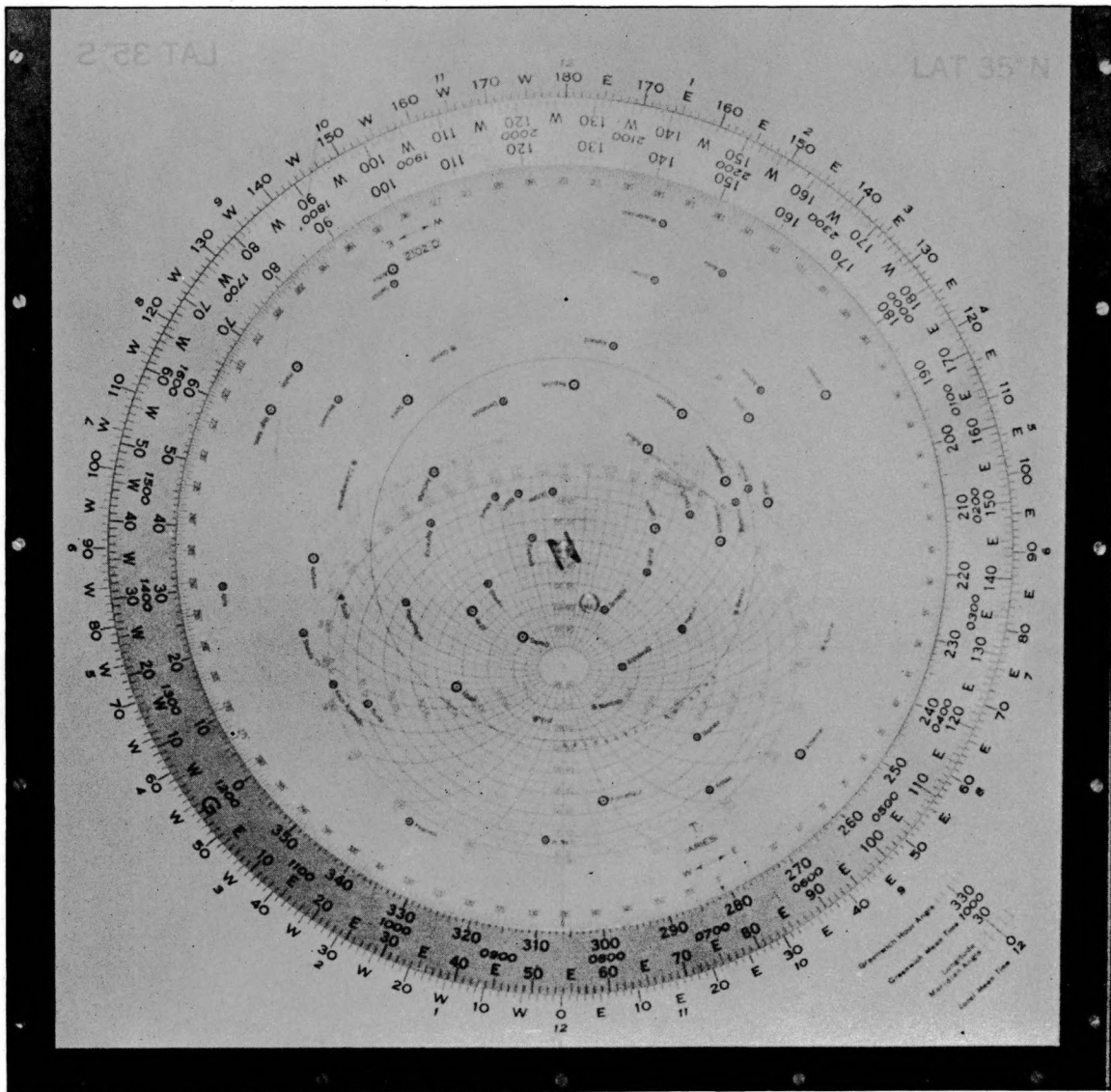
*IBH Note.* — Mr. BLYTHE is a graduate of George Washington University, having acquired the AB and MA Degrees as a mathematics major. He has been employed in the Hydrographic Office since November 1926, where he has contributed extensively in cartography and in the design, development, and preparation of information and material essential to navigation. He is at present Director of the Division of Navigational Science, U. S. Navy Hydrographic Office.

In the conduct of Project MAGNET surveys, many auxiliary items including instruments and equipment are employed in support of the major electronic equipment and to mechanize the procedures as far as possible. An item of possible general interest to navigators is the *star clock* which was designed and developed primarily in the interest of making available a continuous registration of the altitude and azimuth of visible celestial bodies. During flight, observations are made every five minutes of the relative bearing of a celestial body. In view of the small field of the periscopic sextant used, it becomes necessary to have a quick reference to the body's coordinates in order to ascertain its approximate position and to set or reset the sextant without passing over observation periods.

The device, which is positioned near the observer and affixed to the aircraft's fuselage, consists of a stationary part which supports the whole unit and a rotatable part consisting of a drum which rotates freely and to which is attached a synchronous motor and timer. The motor provides one complete rotation within the sidereal day of the plate upon which the stars are projected. As shown in the front view, the stationary part portrays graduations for local time and local hour angle, while the rotating drum (only the ring is visible) carries graduations for longitude, Greenwich Mean Time, and Greenwich Hour Angle. Inset within these graduated circles is the star plate whose periphery is graduated in LHA  $\gamma$  for setting according to the position of  $\gamma$  for the specific instant of setting. To set, it is only necessary to ascertain the GHA  $\gamma$  from the Almanac for the chronometer time, set this value on the star base opposite the G on the rotating drum, and plug into the circuit. No more setting is required since the motor and timer suffice for time changes, and the drum is freely rotated like a wheel of fortune for longitude changes. Altitude and azimuth templates are changed for excessive changes in latitude as is done in using the star finder, the templates being quickly removed and replaced, since they are positioned and held by a groove within the black border area of the clock's perimeter.

While the clock was designed for the survey objective and has proven

an asset in saving time and manpower, as well as adding to the efficiency of the survey mission, it has application to many graphical problems of interest to the navigator. Due to its free rotation to any position and the fact that it is always set, and only necessary after any use to rotate until the local longitude on the rotating drum is coincident with the local meridian, the device becomes a useful one in effecting the rapid solution of most any time or hour-angle problem usually resolved on the plane of the celestial equator. Being easily and quickly set initially and automatic in operation, it affords the navigator many short cuts, eliminates pencil work, diagrams, estimating, calculating and guessing. Other bodies can be immediately located by their declination and GHA, and their coordinates in the horizon system ascertained. Thus approximate times of sunrise, sunset, moonrise, moonset, twilight, times of transit, estimates of time a body will be within certain altitude limits, and numerous problems of this type are readily and easily solved by only slight manipulations. The latest model has an over-all face dimension of 12 inches which could be minimized if necessary, or appreciably enlarged for classroom use. Beyond its application to the specific task for which it was manufactured and to the navigator's time problems in general, it is a device which would likely have considerable interest to the student, instructor, amateur astronomer, and novice. (Patent pending).



Front View of Star Clock.