An astro compass is designed to provide *true* direction, requiring a conversion to grid direction before comparison with a directional gyro set to a grid heading. Some squadrons operating continuously in polar regions modify their astro compasses to provide direct reading of grid direction. This is done by inserting an additional longitude scale (the black-on-white scale near the bottom of fig. 2613a) opposite the true course (heading) scale. To do this it is necessary to disassemble the astro compass and move the spirit-level assembly outward to make room for the new scale. This scale is fixed with respect to the true course (heading) index. Observations are made in the usual manner. True heading can be read at the true course (heading) index, as usual, or grid heading can be read on the heading scale opposite longitude on the additional scale.

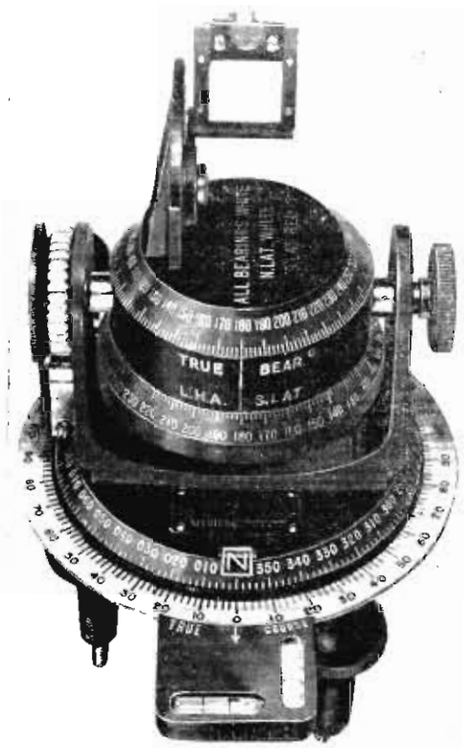

FIGURE 2613a.—Astro compass modified for grid navigation.

If a periscopic sextant is available, it can be used instead of an astro compass to check the directional gyro.

Before the astro compass was developed, a **sun compass** (fig. 2613b) was used for this purpose. The sun compass, operating on the same principle as the astro compass, is seldom if ever used by the modern polar navigator because its use is limited to the sun. The astro compass is usable with any celestial body.

The sky compass (art. 2510) may be used to check the directional gyro during periods of twilight, or if the sun is obscured by clouds when near the horizon, at which times no celestial body may be visible.

While frequent checks of the directional gyro are desirable, the development of highly reliable low-drift-rate directional gyros has made the matter of determining direction on polar flights less critical than during the early days of polar flying. Consequently, with proper precautions, the modern polar navigator can fly long missions without fear of disaster because of inability to maintain direction.

2614. Drift and ground speed can be found by any method available. However, since precise fixes are unusual in polar regions, and any fixes are rare over the Arctic Ocean in summer, the method of determining wind by simultaneous no-wind and ground positions is not regularly available. Forecast winds are not always reliable because of the unavailability of reports from an adequate number of stations. Four methods are in general use:

Driftmeter. Visual observations of drift and ground speed are made by observation of some prominent feature of the ice or terrain, when the surface is visible. However, it is not unusual for an undercast to obscure the surface for hours at a time. Also,

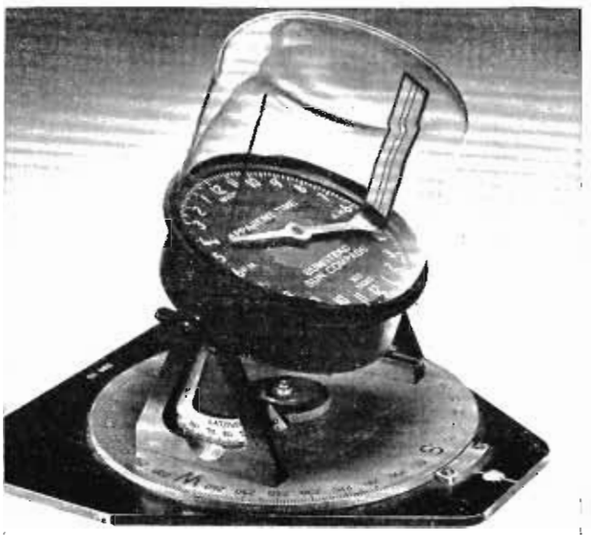

FIGURE 2613b.—Sun compass.

if ground speed is to be measured, accurate determination of height above the feature used must be available. Usually this is provided by an absolute altimeter. When heading is being maintained by directional gyro, it is not good practice to fly a wind star, if the radical heading changes are likely to disturb the gyro drift rate. The driftmeter should be winterized before being exposed to extreme temperature. The B-3 and B-6 driftmeters supplied naval aircraft operating in polar regions are generally winterized to operate in temperatures as low as (—) 65° F. The power and functioning of this instrument should be checked, and the lenses cleaned, before use. The gyro should be started and allowed to warm up for half an hour before being uncaged. The reticle light should be adjusted to the proper intensity before the aircraft is exposed to low temperatures, because the rheostats are difficult or impossible to turn when cold.

Radar. By means of radar a prominent feature can be tracked even though an undercast obscures the surface to visual observation. The method of doing this is explained in article 1215. The results obtained by radar should check closely with those by driftmeter if a good target is selected and a careful reading is made. Over pack ice, a dark area is generally preferable to a light area, because the bright area is likely to change more as the aspect changes, and may even be lost as the target is passed and the opposite side is illuminated.

Pressure. Average drift over a period of time, usually half an hour, can be obtained by the formula developed by Dr. John C. Bellamy, as explained in article 1508. This pressure or "Bellamy" drift is normally available only over the sea, and there only if both absolute and barometric altimeters are available. Giving an average over a period of time, rather than a nearly simultaneous value, Bellamy drift is useful for dead reckoning. However, its accuracy decreases with increased curvature of the isobars.

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