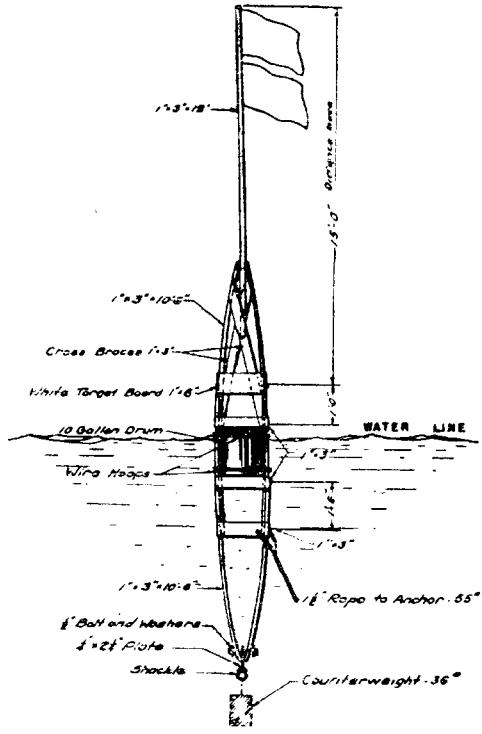
SMALL BUOY USED IN DEVELOPMENT OF SHOALS.

(Extract from the article appearing in "Hydrographic Survey Aids" by H.C. WARWICK, Hydrographic and Geodetic Engineer Commanding, U.S. Coast and Geodetic Survey Ship *Pathfinder,* published in the *Field Engineers Bulletin,* N° 13, Washington, December 1939).

The insular shelf off the northwest coast of Palawan Island, P.I., extends some 35 miles offshore but the survey of this area offers sufficient problems to keep it from being an almost unbearably monotonous task. A brief description of the local conditions encountered here seems desirable to explain the necessity of employing the various means used to accomplish the survey.



While surveying in this area a lookout is kept in the crow's nest at all times, and frequently, if the sun is in favorable position, shoals are detected a mile or more away by the light green color of the water. Bearings are taken to the discolored spot and the approximate position is plotted on the boat sheet. At an appropriate time, when weather and other conditions are suitable, one of the ship's launches is lowered to develop thoroughly the shoal or shoals. Naturally it is impossible for the launch to take and plot fixes from shore objects, so a small buoy, a miniature design of the standard barrel hydrographic buoy (see Figure), is anchored as near the center of the shoal to be developed as feasible, and located by the ship or launch from shore objects. This buoy has a target at the top and one just above the water line, exactly fifteen feet apart. To determine a fix, the launch party observes the azimuth to the buoy with an azimuth circle on an extra boat compass

and the vertical angle between the two targets on the buoy. The party is furnished with a graph giving distances up to 800 meters for angles from 24° to 0° 20' based on the formula,

$$d = 0.3048 \frac{15}{\tan \alpha}$$

in which "d" is the desired distance from the buoy in meters, "15", the distance in feet between upper and lower targets on the buoy, "a" the observed angle between targets and 0.3048 the factor to reduce feet to meters.

The buoy must be kept almost vertical, so more than the usual counterweight is necessary. Furthermore, it can be used successfully only on comparatively calm days.

The positions obtained in vertical angle and bearing are plotted on a small "rose" sheet which has every ten degrees of azimuth drawn on it and so numbered that the azimuth from launch to buoy may be used on it without conversion; the buoy position is taken as the intersection of the azimuth lines. In practice, the "rose" sheet is about twice the size of the figure shown.