A DEVICE WITH OUTRIGGERS FOR INCREASING SOUNDING WIDTH (*)

by Kishimatsu WATANABE

INTRODUCTION

With the eventual object of enriching the national industrial economy Japan has worked out a nation-wide plan for the expansion of port accommodation and facilities, in order to relieve recent growing congestion in ports and harbours caused by great increases in marine transportation. As a consequence of the implementation of this plan there has arisen a need to publish the relevant nautical charts so as to keep the user informed of progress in harbour constructions. In order to issue these essential tools for the safe navigation of ships, accurate and timely hydrographic surveys are indispensable. To keep abreast of the progress in harbour construction, as well as the growth in the size of vessels, it is necessary to promote efficiency in hydrographic surveying by using more highly mechanized methods, and in this way to ensure greater safety in navigation. As one of the measures towards fulfilling these requirements the author designed and produced a device for increasing effective sounding width.

I. — ESSENTIAL DESIGN REQUIREMENTS

The most essential requirements which were taken into account when designing the device were the following .

(1) Compactness of size. The device's outboard units (a pair of arms and a pair of floats) should be so compact that they may be easily mounted or housed aboard an existing survey craft, length 11 metres, width 2.8 metres, draught 1.1 metres, and which, with a 25 PS diesel engine, runs at a speed of 6.7 knots.

(2) Little resistance against waves, so that in consequence neither the hull nor the propeller will be liable to be damaged.

(3) Strong and light metals for the arms and floats to make them resistant to waves.

(*) *Editor's Note.* An article on a similar subject was published in the January 1963 issue of the IH Review, page 23.

(4) Simple, convenient, reliable and time-saving mounting and housing of the device both before and after the sounding operations.

(5) Constant draught for the transducers fitted to each arm, in order to avoid the effect of waves during the operation.

II. — STRUCTURE OF OUTBOARD UNITS

1° Outrigger arm

The arm is constructed of a 2.8 mm 'lip channel' light gauge steel weighing 2.8 kg per metre, and is 6.5 m long, 10 cm wide, 4.5 cm high. Since by itself this steel bar is likely to be twisted or bent — due to the up-and-down motion of the float attached to it — as a reinforcement the bar is backed with a 1.5 mm iron plate welded so as to close the 'lip' all along its length. At the inner end of the arm a joint is attached, enabling the arm to move vertically.

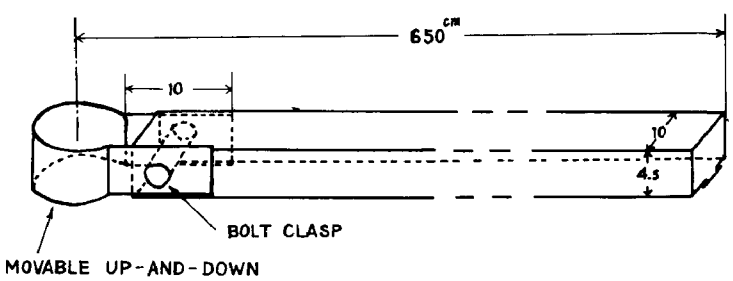

Fig. 1. — Arm of outrigger.

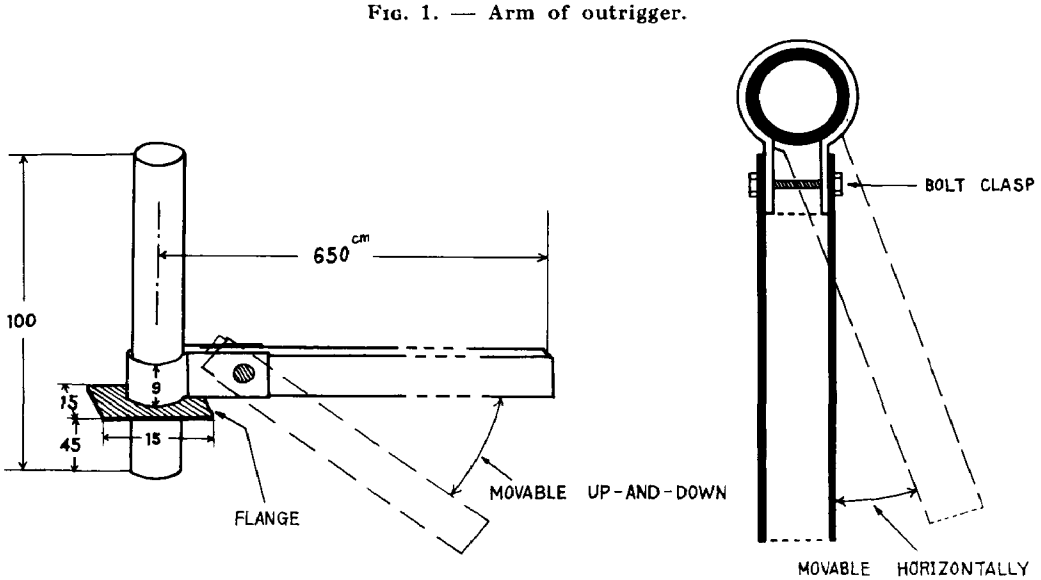

Fig. 2. — Support of outrigger.

2° Stay for the arm

In order also to make the arm movable horizontally a cylindrical pipe is erected as a stay on either beam of the survey craft, utilizing a hole originally designed for the mounting of a transducer unit in an ordinary echo-sounding operation.

With this stay as an axis, the collar joint can swing around, thus the arm is movable both vertically and horizontally. A rope is wound round the stay close below its flange — composed of a square iron plate — leaving a gap of about 2 cm around the stay. This leaves an allowance for tilting of the stay during operation, the rope serving as a cushion.

3° Float

A large sweeping survey type buoy, weighing about 36 kg and having a buoyancy of about 100 kg, has been converted for this purpose. The essential requirement was to reduce its wave-making tendency by increasing its buoyancy and wave cutting capacity. The front tip of the buoy has therefore been sharpened, and a horizontal fin attached beneath the buoy in order to reduce the occurrence of eddies to a minimum. This conversion enables the bottom of the float to run so closely below the water surface that the draught of the transducers is kept constant and the craft's speed not appreciably reduced. As to the angle of inclination of the float, it has been assumed that if the float is inclined at an angle of more than 10° to the water surface the body may hit the waves in such a way that the tail is likely to submerge, causing an increased resistance. The arm could, in

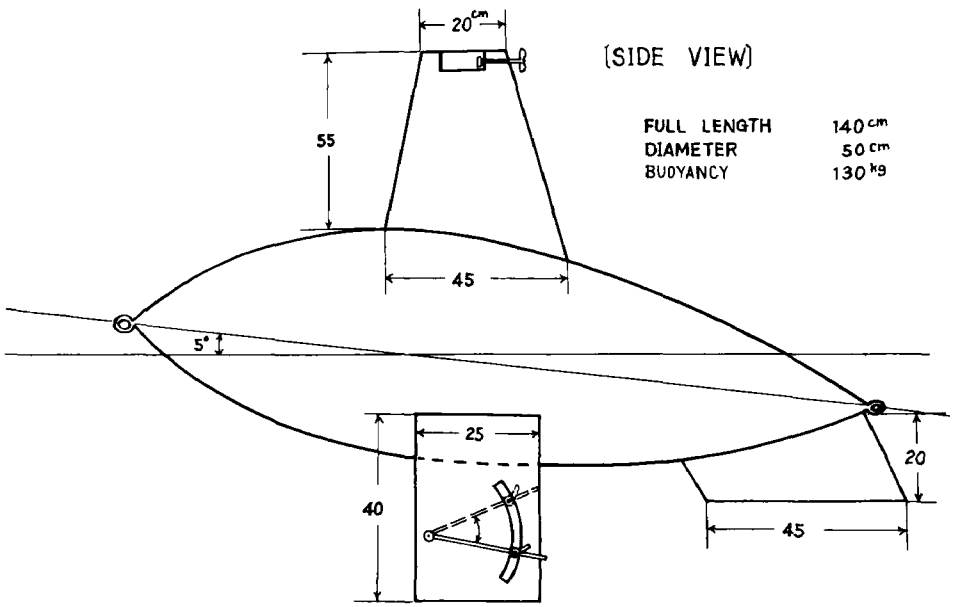

FIG. 3. — Side view of float.

consequence, be twisted or bent following even a slight shock from hitting a wave. From tests the best angle has finally been determined to be about 5°.

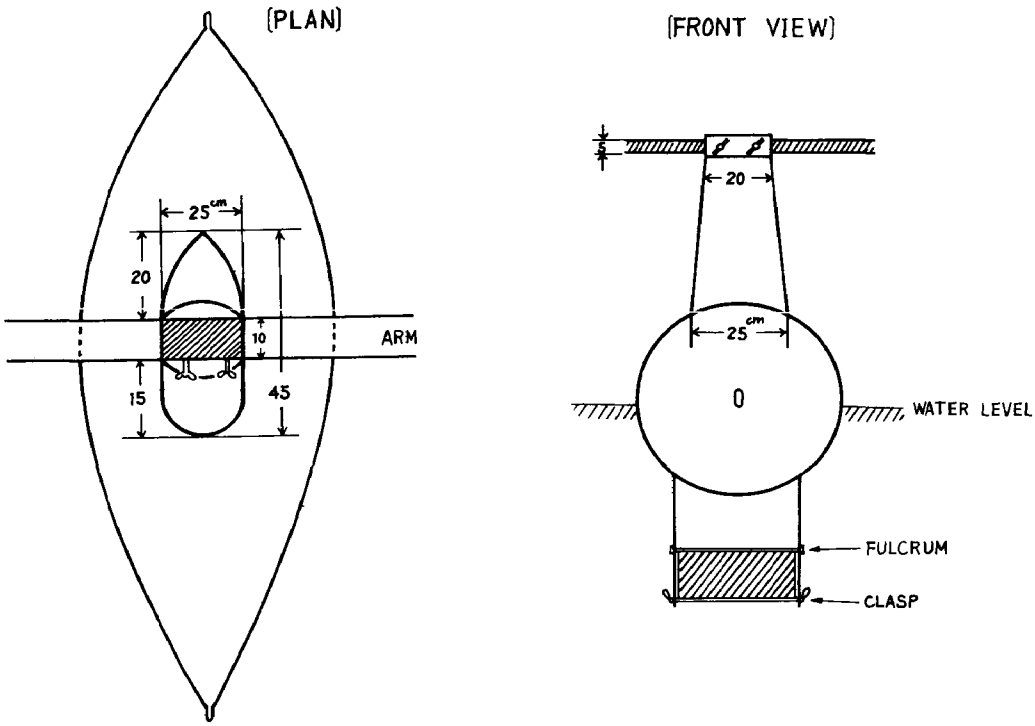

FIG. 4. — Plan and front view of float.

The float stay is hollow in order to increase its buoyancy. It is fitted to the arm by means of a sliding fitting, enabling the float to be positioned at will on the arm, since the distance between the float and the hull must be adjusted according to the depth to be sounded. The horizontal fin fitted beneath the float must be adjusted to the angle which will stabilize the draught of the float, and consequently that of the transducers.

4° Mounting of transducer units

It is necessary that the spacing between each pair of transducers be fixed at the optimum distance for the depth of water to be sounded. The fitting used for attaching the transducer tube to the arm must therefore be able to slide along the arm. In order to facilitate mounting a plug-in fitting has been devised. Then a draught-band (shown in figure 5) is fitted to the tube to enable the transducer draught to be fixed for the desired depth, and the tube is inserted into a hole in the fitting and the draught-band is inserted into its slit at the bottom of the fitting. The tube is then fixed by tightening the clasp at the top of the fitting. In this way the transducer is fixed to run at the desired depth of water.

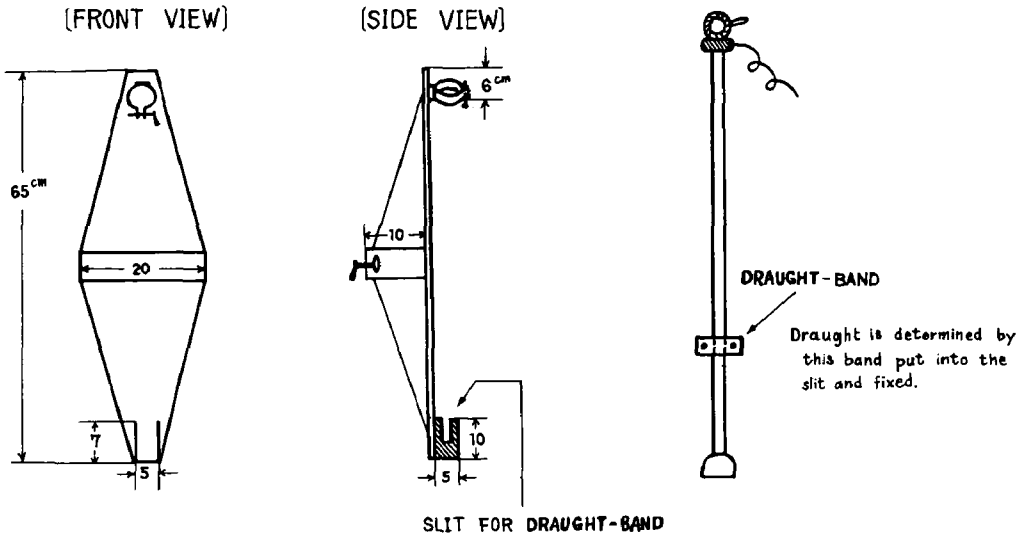

Fig. 5. — Mounting device.

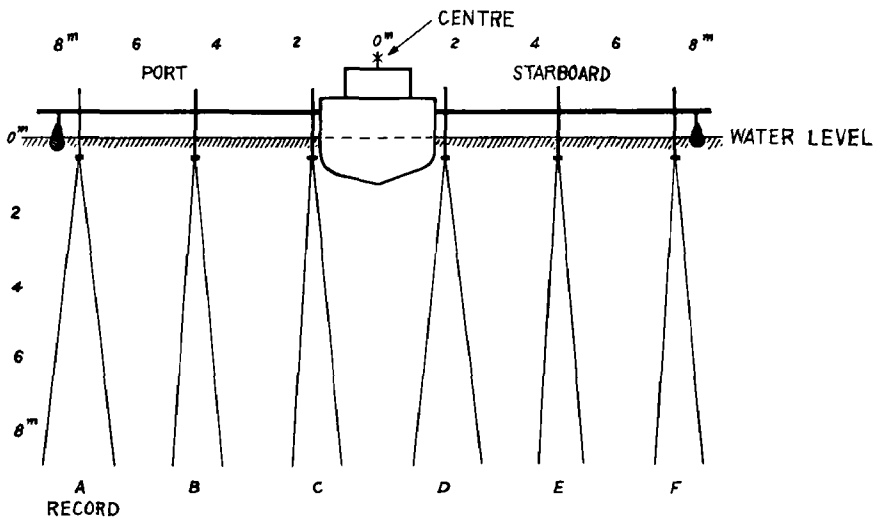

Fig. 6. — Scheme of device for increasing sounding width.

5° Draught-band for transducer

This is a band of iron plate, 1.5 cm wide and 1.5 mm thick. The band is fitted to the transducer tube after being properly adjusted to the transducer draught.

III. — RESULTS OBTAINED

1° Reduction in speed and increase in tactical semidiameter of the survey craft

When the survey craft was equipped with the outboard units on both sides it ran at a speed of about 6.2 knots, with the engine turning at 1 100 rpm. This was about 0.5 knot slower than the ordinary operating speed. The tactical semidiameter was about 15 metres for both port and starboard turnings, and this was about 2 metres more than the ordinary value. Steerage was felt to be slightly heavier than usual.

2° Strength of arms

Both arms were reinforced with a 1.5 mm thick iron plate so that they could withstand even rough seas.

3° Vertical movement of arms

While under way, the float ran at a constant depth of water, so that the draught of each transducer remained constant. From the echogram, shown in photo 1, which was taken in a rough sea condition with following waves, it is seen that the vertical movement of the outermost transducer was about 1/3 less than that of the innermost one mounted on the beam of the craft.

In photo 1, from the top downwards, we can see :

(1) The record from the transducer mounted on the beam of the craft;

(2) The record from the transducer mounted on the arm at a distance of 3 metres from the craft's beam;

(3) The record from the transducer at a distance of 6 metres from the craft's beam.

Weather and sea conditions were as follows :

Weather : Fair, with a westerly wind of about 10 m/s.

Sea : Wave crests were breaking.

4° Reading of echograms

Soundings were carried out with six transducers, three on each side of the survey craft. The configurations of the bottom of the sea can be well detected on photo 2; upper part, traces of echo sounders A, B and C (starboard), lower part D, E and F (port).

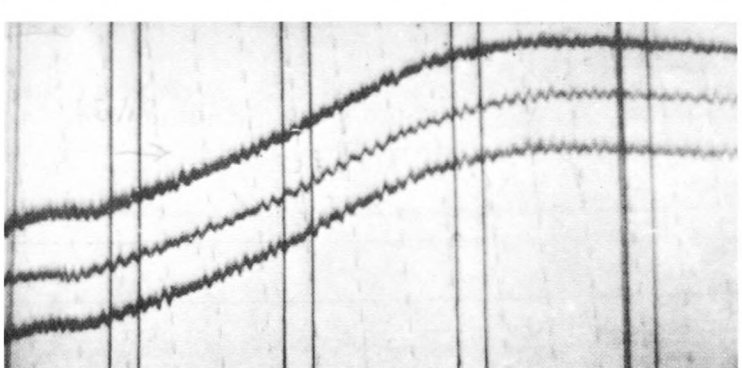

Photo 1

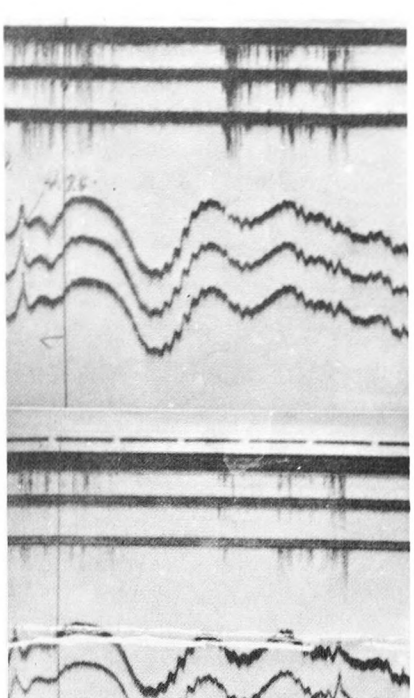

Photo 2

Photo 3

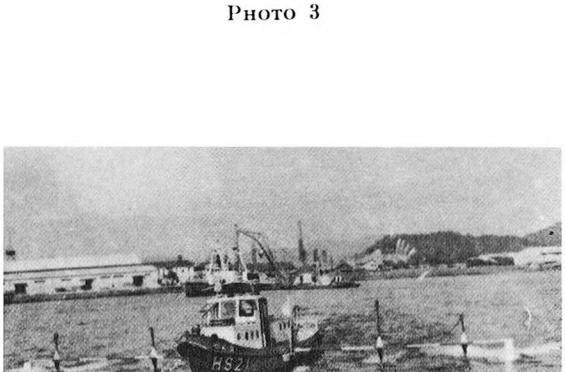

Photo 4

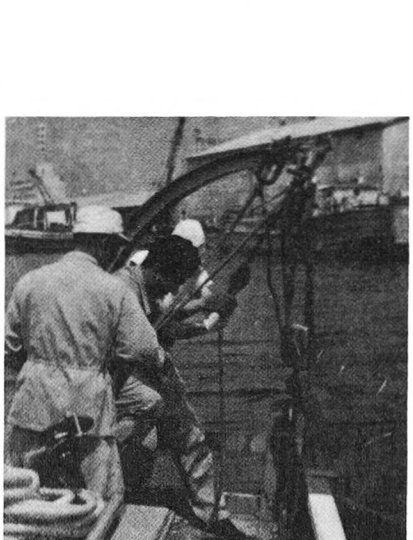

Photo 5

5° Installation and removal of device

A hoist fitted at the craft's stern serves to facilitate the mounting and the housing of the arms. The floats are housed on the arm rest. (Photos 3, 4 and 5).

ACKNOWLEDGEMENTS

The device was perfected as the Hydrographic Division of the 6th Regional Maritime Safety Headquarters. It provides increased efficiency in hydrographic surveying to improve the safety of navigation.

The author wishes to express his appreciation to Mr. Kazuhiko SATO, Special Assistant to the Chief of the Surveying Section, Hydrographic Division of the Maritime Safety Agency, for his kind instructions and guidance in the preparation of this paper. Appreciation is also extended to members of the Hydrographic Division of the 6th Regional Maritime Safety Headquarters for their cooperation in the production of the device.