**New NANNITI-ITO Current Meter**

Tosio NANNITI** and Kimie ITO***

**Abstract:** A new deep-sea current meter is presented which will record both the current speed and direction on the recording paper. The recording will last continuously for about 3.5 days, the maximum recommended depth for use is 1,000 m.

1. **The general design criteria for the instrument**

The instrument was designed to record both the direction and speed of currents in the deep ocean. The recording consists of 20 m of paper on which the speed is recorded by electric pulses, and the direction, that is also the time mark, is recorded by the four kinds of colors and the height from the bottom of the paper.

The general design criteria for the instrument are as follows:

- minimum starting speed: 1 cm sec\(^{-1}\)
- maximum speed: 100 cm sec\(^{-1}\)
- maximum recommended depth for pressure case: 1,000 m
- recording: 1 pulse for every revolution or 1 pulse for every 8, 16, 32, 64 or 128 revolutions. Paper advanced by micro-motor at 180 mm h\(^{-1}\), its width is 40 mm.

2. **Speed sensor unit**

The both ends of the propeller, diameter 80 mm, are set on the end-stones in the pivot holes. The small magnet is mounted on the propeller. (Fig. 1) An electric coil is set very near to the magnet, so an electric pulse will be emitted for each rotation of the propeller. The signals are amplified and recorded one by one, or reduced by 1/8, 1/16, 1/32, 1/64, 1/128 and then recorded on the paper with ink.

3. **Direction sensor unit**

The current meter has a bi-vane to follow the current direction. (Fig. 2) The light weight cylinder is set on the end-stones in the pivot holes to keep the magnetic direction with the attached magnets, it does not follow the current direction. The four colored helical lines (red, green, black, purple) are drawn on the each quarter of the cylinder's surface from its top to the bottom. The each colored line is oriented...
Fig. 3. Inner parts of current meter.

90° to the both side lines. (Fig. 3) By the action of the cam, the paper will be pressed to the cylinder’s surface at the interval of 10 minutes controlled by the micromotor. (Fig. 4)

The height of the pressed mark from the bottom of the paper and its color tell the current direction and the observing time.

4. The electric circuit and operation

Fig. 4 is the circuit diagram for the instrument. The speed signals are amplified by modulation method, and are recorded by 1/1, or 1/8, 1/16, ... etc., selecting the reducing range of flip-flop circuit according to the current speed.

Power for the circuit are derived from 28 dry cells (UM-1) and are sufficient for the 20 meters long data strip.

An example of record is shown in Fig. 5.

Fig. 4. Circuit diagram of current meter.

Fig. 5. Current meter record.