DIRECT MEASUREMENT OF OCEAN CURRENTS (1)

by M. V. ROMANOVSKY

Assistant, Oceanographical Institute.

M. Romanovsky points out in his article that although adequate instruments are available for measuring the average direction and velocity of ocean currents, there is a lack of current-meters that are sensitive to low rates of speed or that are capable of registering velocities for a given instant. Current measuring far out at sea is moreover impossible at present, although Norwegian experts hope to solve the problem with the development of radio-navigation.

Among the instruments described are those equipped with impellers, based on the rotation speed measurement of a rotor, and divided into two main categories. The former consists of equipment with helicoidal blades, the axis of which is parallel to the current, and it includes Ekman's mechanically recording current-meter, together with Sverdrup's and Dahl's instrument, which uses an electrical circuit. Also falling within this group is the recently developed Roberts current meter, which uses a system of radio transmission and is able to record approximately instantaneous velocity rates. In the latter group, characterized by apparatus using a cup-type of impeller, and with the axis of the revolving mechanism perpendicular to the current, the author mentions the Carruthers and Boccardi current-meters, both equipped with mechanical recording devices, O. Petterson's photographic current-recorder, and he gives a detailed description of P. Idrac's current-measurer. The advantages of this latter instrument appear to be numerous, but the fact that the impeller mechanism is enclosed in a tunnel-like arrangement changes the conditions of flow, and information obtained for weak currents is unreliable. P. Idrac was also the first to construct an instrument giving the vertical component of current velocity.

According to the author, current-meters in the first category are preferable to rotors with a vertical axis, and the photographic recording method most satisfactory. The recording mechanism, he says, should be enclosed in a water-tight compartment in the instrument itself and electric cables connecting the apparatus to the ship eliminated. It might be desirable, he adds, to combine electrical and photographic systems for a higher degree of accuracy.

There are two instruments based on the pendulum principle — F. Nansen's current-meter and Y. Delage's *bathyrheometer*. The latter is essentially composed of a sphere containing a movable frame and a pendulum, separated from the bottom by a length of rod joined by gimbals to a mooring block. It can therefore only be used to measure the direction and velocity of currents close to the sea-bottom, but it can on the other hand record instantaneous velocities.

The author then rapidly reviews the Pitot tube, circular plate, and float systems, all of which are simpler in design but lacking in sensitivity.

Interesting results were obtained from a photographic device perfected in 1940 by M. Ewing, A. Vine and J. L. Worzel which takes pictures of the sea-bottom. A metal triangle painted white carrying a water-tight compass, and from which white balls of varying density and diameter were hung, was placed horizontalwise a few feet from the bottom, which was lighted by two projectors. The photograph showed the degree of deflection of the balls caused by the current, and the picture of the compass gave the direction of flow. It was possible in this way to obtain data on currents at depths up to 355 fathoms.

The author finally recommends the designing, which so far has not been accomplished, of instruments using heated stainless metal wire, similar to the anemometers used in aerodynamics. The small volume of the wire would scarcely interfere with the flow, the antenna could be easily directed and could therefore measure all the velocity components, the sensitivity of the equipment would make it possible to obtain accurate data on extremely weak currents and the heated wire's low inertia would enable the rate of speed at any specific moment to be determined.

M. Romanovsky ends his article by saying that it is not possible to construct a perfect instrument, but that by discarding vane methods and the Pitot tube and by concentrating on bathyrheometers, and diaphragm and heated wire appliances, it should be possible to develop an instrument giving satisfactory results in the measurement of instantaneous ocean current velocity.

J. P. S.

(1) Extract from publication No. 1357 of the Navy Hydrographic Service, Paris, 1949.