INFORMATION FOR OBSERVERS AT AN OPERATIONAL DEMONSTRATION OF THE ELECTROMAGNETIC FLOWMETER (NAVY LOG METER) IN THE BUREAU OF RECLAMATION HYDRAULIC LABORATORY

The Electromagnetic Flowmeter system being demonstrated was loaned to us by the Department of the Navy and will be returned in the near future. There are no plans for calibration or testing of the system or any of its components. The purpose of the demonstration is to acquaint Bureau personnel with the instrument so thought can be given during planning, design, or operation of Bureau projects to possible uses of the system. Considerations for its use in our work will undoubtedly be influenced by results of development work described in the last paragraph of the attached extract.

The following has been extracted from the paper "New Instruments of the United States Geological Survey for the Measurement of Tidal Flow" 1/ by E. G. Barron, Hydraulic Engineer, Research Section, Surface Water Branch, U. S. Geological Survey, Columbus, Ohio.

THE ELECTROMAGNETIC FLOWMETER

This instrument was originally developed as a ship's log for the Navy. In 1956, permission was obtained from the Navy to purchase one instrument from Control Instrument Company, the supplier of this equipment at that time.

As used on shipboard, the instrument indicated the speed of the vessel and the accumulated distance traveled. As modified for use in streamflow measurement, the instrument indicates and continuously records the velocity at a fixed point in a stream cross-section.

This instrument measures the velocity of water by a method which is based on Faraday's Principle: An electrical voltage is generated by the motion of an electrical conductor in a magnetic field.

The complete system consists of four major components: rodmeter, oscillator-amplifier unit, indicator-transmitter unit, and recorder. The Rodmeter is streamlined in cross-section and about three feet long. The upper part is bronze with a glass reinforced plastic shell on the lower end. Embedded in the plastic shell are an electromagnet and two pick-up buttons, or terminals, mounted flush with the shell. These two buttons form a part of a pick-up loop which is completed through the water.

The Rodmeter exciter coil is energized by the oscillator operating at a frequency of between 65 and 70 cycles to reduce the effect of stray 60-cycle fields in the water. The water, flowing through the magnetic field in the water, generates a voltage which is picked up by the buttons and which is proportional to the water velocity. The signal from the probe is amplified and recorded on strip-chart recorder.

1/ A paper presented at the Eighth National Conference, Hydraulics Division, ASCE, Fort Collins, Colorado, July 1-3, 1959.

During laboratory tests and calibration, the Flowmeter was found to be very sensitive to slight changes in velocity and capable of measuring velocity in either upstream or downstream direction with respect to the Rodmeter. The recording of a constant velocity for long periods indicated freedom from long term drift. At a given velocity, the deviations in the recorded values were small in percent except for velocities below one foot per second. However, even the recording of the very low velocities would average out in a relatively short time. It was noted that a sudden 180° rotation of the Rodmeter in the flow, would produce a shift in the calibration which required several hours to return to true value. This would not be objectionable even in reversing tidal flow as such reversals would occur gradually over periods of several hours.

The Electromagnetic Flowmeter was installed on St. Johns River at Jacksonville, Florida in November 1957. The range of velocities during each tidal cycle is about six feet per second downstream and four feet per second upstream.

The Rodmeter is mounted on a hinged truss so that it is supported vertically in the flow about twenty-five feet out from the downstream end of a central pier on the side away from the navigation channel. The top of the Rodmeter is about three feet below the minimum water level and the sensing end is about five feet below minimum level.

The performance of the Flowmeter since its installation has been quite satisfactory. The sensitivity and response is so good that some trouble has been experienced with wear in the gears of the indicator and with the ink soaking the recorder chart so that pen tears the paper.

The Flowmeter has been calibrated in place and is now used in the computation of the discharge of the St. Johns River at Jacksonville, Florida.

A contract was recently awarded for further development and improvement of the Electromagnetic Flowmeter. The purpose of this contract is to better adapt the instrument for use in continuous recording of river velocities. This should result in improved circuitry that will require less maintenance, in slowing the response to avoid wear of servo components, and in smaller-sized rodmeter or probe. The cost of the complete instrument, after redesign, is estimated at about $3,500.