RECORDING TIDE-GAUGE WITH DISTANT RECORDER.

RAUSCHELBACH SYSTEM.

(TYPE OCEAN 2).

This apparatus, constructed by the Askania-Werke A. G. (Bambergwerk), Berlin-Friedenau (Kaiserallee 87-88), is described in a special pamphlet issued by the firm. Extracts therefrom are given below.

PRELIMINARY OBSERVATIONS.

Recording at a distance, which has been employed for registering thermal, electric, meteorological and other phenomena, plays an important rôle in the transmission to a distance of records of water levels, for the float-wells are often placed at considerable distances from the sites of work or observation and, generally, they are not suited to contain delicate instruments.

Particularly good transmission is required for the purpose of comparing the recorded curves with those previously calculated by means of a tide-predicting machine, both for checking the harmonic constants of the port in question and for determining the influence of local and temporary happenings which cannot be taken into account in the calculations, such as, for example, the direction and force of the wind.

Transmission to a distance of tide-gauge records, as devised up to now, has not fulfilled these requirements. On the initiative and with the collaboration of Dr. RAUSCHELBACH, of the *Deutsche Seewarte* of Hamburg, the Askania-Werke has constructed a distant recorder which was found, after conclusive tests carried out by the *Wasserbauamt*, Wesermünde, in 1926-1928, to fulfil all exigencies.

At the German stations where it has been fitted, this distant registering tide-gauge makes records on paper strips on which the curves of the German tide-predicting machine have been previously inserted. As this cannot be attained by means of a drum instrument, a horizontal table instrument was constructed ; this arrangement allows a better appreciation of the phenomenon during the preceding day to be made and makes it possible to carry out direct measurements with the greatest ease. Though the essential parts of the instrument have been constructed to suit the dimensions of the German tide-predicting machine, the width and movement of the recording strip can be adapted without difficulty to other similar devices.

DESCRIPTION OF THE DISTANT RECORDER.

Distant recording is carried out electrically, by means of a transmitter placed directly over the float-well and a receiver which can be placed at any desired distance from the float-well, in the offices of the water-works or of the Port Authorities, etc. The two instruments are connected by a cable with four conductors, encased, if necessary, in a lead cover and the distance between them is determined by local conditions. In the case of the instruments so far erected by the Askania-Werke, the distance has been from 2 to 3 kilometres. The accuracy of the record is very great ; for example, within 1 $^{c}/_{m}$ in 10 m. change in water-level.

THE TRANSMITTER.

The transmitter is placed directly above the float-well and is composed of a wheel connected with the float. The diameter of the wheel is such that one complete turn of wheel corresponds to a difference of 1 m. in the height of the water. This wheel is firmly fixed to a drum round which the wire of the counter-weight of the float is rolled. The float is 300 $^{m}/_{m}$ in diameter and about 200 $^{m}/_{m}$ high.

It is attached to the wheel by means of a copper cable, about 20 metres in length the greater part of which is wound round the periphery of the float-wheel. The weight of the float is counterbalanced to the desired extent by means of a counter-weight. The movements of the wheel, caused by the oscillations of the water-level, are transmitted to a make and break by two toothed wheels. By suitably modifying the diameter and size of the drum and the gearing of the make and break, the transmitter can be adapted to quite a number of amplitudes of oscillation.

The complete transmitting gear is contained in a case to protect it from the weather or any other causes of deterioration.

THE RECEIVER.

The receiving apparatus comprises a recorder table, the recording device with a make and break and a clockwork for moving the paper. The recorder table is of such dimensions that it is possible to examine the whole of the curve drawn during 24 hours at normal rate of movement of the paper. Underneath the table is placed on one side the paper feed-roller and a guide-roller; on the other side, the driving-roller and the reception-roller. The feed-roller and the reception-roller are easily removed and are interchangeable, but the guide-roller and the driving-roller are part and parcel of the frame of the table. The driving-roller has an accurate regulating device for the time marking. A pressure cylinder presses the strip on to the periphery and the toothed rings of the driving-roller.

The recording strip is 50 $^{c}/_{m}$ wide; the feed-roller and the reception-roller are of such dimensions that they can contain 19 metres of paper, which corresponds to a month's consumption of paper. The movement of the paper is so regulated that it advances 24 millimetres in one hour. The record of the movement of the tide is made on the scale of 1:20; thus 1 $^{m}/_{m}$ on the paper corresponds to a variation of level of 2 $^{c}/_{m}$. The width of the record and the movement of the paper may be adapted to other scales, however.

For the purpose of comparing the records with the curves of the tide-predicting machine, the advance of the paper must be extremely accurate. The instrument has, therefore, been fitted with a precision clock movement (RIEFLER system), with an invar-steel pendulum beating half seconds. This movement winds itself automatically about every 10 hours, by means of an electric motor which winds the paper driving mechanism also at the same intervals.

In the frame of the table, there is a special motor connected by a cable to the float-well transmitter. The impulses sent out by the transmitter at each make of contact are transmitted to the special motor.

This intermittent rotary movement of the motor is transformed into a linear movement and is communicated to the inscribing gear by a carriage, fitted with an articulated stylus. This stylus is guided by two steel sheaves and moves at right-angles to the advance of the paper.

At a little distance from this stylus there are four pencils for inscribing the ordinates, one of which makes the hour marks by means of a make and break in the clock and an electro-magnet. The whole of the inscribing gear is protected against dust and deterioration by a glass case.

Further, the height of the tide (which corresponds to the position of the recording stylus) can be read off directly in metres and centimetres on a scale attached to the frame.

For supplying the current, two 12 volt accumulators of large capacity are used; these are connected to the local mains for charging alternatively so that, in case of failure of current in the local mains, the tide-gauge shall not be deprived of current.

The complete apparatus is contained in 2 cases, of the following dimensions:

	Dimensions of Cases.			Weights of Cases.	
	length $^{c}/_{m}$	*width* $^{c}/_{m}$	*height* $^{c}/_{m}$	*net* kg.	*brut* kg.
Table	150	135	110	120	367
Receiver	90	90	80	55	85