CONTINUOUS AIR FLOW TIDE GAUGE

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IHB Note. — There is nothing new under the sun. At an interval of more than half a century the same idea has given rise to the construction of two tide gauges. It was, in fact, by using the same basic principle that both the early French instrument, described in the following article, and the recently developed tide gauge of the U. S. C. & G. S. were constructed. A description of the latter instrument was published in a preceding number of this Review.

Readers of the Review will no doubt find it of interest to note how technical progress in specific branches (electronics for instance) tends to make its influence felt in very different fields of application and how it is capable of infusing new life into them.

A recent article by Mr. Austin C. POLING and Mr. Wesley M. BUTLER (*) gives a description of a Gas Purging Pressure Tide Gauge which the Coast and Geodetic Survey developed a while ago based on a principle used in the United States for measuring the level of liquid in tanks and reservoirs.

Readers of the International Hydrographic Review will certainly be interested to learn that a similar tide gauge was used in several French coastal ports in the course of the first forty years of this century. About the year 1900 the PARENTHOU firm had in fact developed in Paris a pressure tide gauge in which the sensitive element consisted of a watertight elastic pocket joined to a pressure-gauge system by means of a tube.

This pressure sensitive element did not prove satisfactory in waters which contained particles in suspension, and moreover it was difficult to ensure that the tube was absolutely watertight.

Furthermore, in the year 1903 an improved instrument had been constructed on the same principle in the workshops of the Maritime Service of the Gironde, under the direction of two engineers of the Service des Ponts et Chaussées named VIDAL and KAUFFMANN (**), but the pressure sensitive unit was simply an open tube in which a permanent flow of air prevented the entry of water. This tide gauge was designed for tidal observations in places which were not suitable for the installation of float-type tide gauges.

(*) The Gas Purging Pressure Tide Gauge. *International Hydrographic Review*, Vol. XL, No. 1, January 1963, pp. 103-112.

(**) VIDAL and KAUFFMANN : Note n° 27 sur les Indicateurs de hauteur d'eau à courant d'air continu. *Annales des Ponts et Chaussées*, 1re partie, 1905, 2e trimestre.

The facility of the apparatus in filtering out the changes in level due to swell was ensured by means of a pneumatic connection between the immersed part of the recorder and by the constriction of the mercury pressure gauge.

Since 1904 the engineers indicated that the results obtained at La Coubre were most satisfactory, and that the curves recorded by the tide gauge were extremely regular. Furthermore by means of turning the cock placed between the two branches of the mercury pressure gauge it was possible to obtain continuous curves even during full gales.

Tide gauges of this type have been used in the approaches of the Gironde Estuary, particularly at La Coubre and at La Pointe de Grave. Another was installed in the port of Le Havre where it remained in service until it was destroyed in the course of operations during the second world war : it was a precision instrument with which it was possible to measure to within a centimetre the height of the water level.

Continuous air flow tide gauges have been described in various lectures on tides given at the French Naval Hydrographic Service. The paragraph devoted to these tide gauges in the work of ROLLET DE L'ISLE published in 1905, entitled : *Observation, étude et prédiction des marées* (Observation, Study and Prediction of Tides), will be found in the Appendix to this article.

Furthermore, a few years ago Ingénieur en chef EYRIES had constructed a similar instrument with the name "Purging Tide Gauge" destined for recording of the tide on a slightly inclined coast or on board a hydrographic ship at anchor. The escape of air is produced by a capillary tube, and is controlled by a Bourdon-type pressure gauge. It is possible in this way to ensure that the pressure of water is transmitted to the instrument without risk of the dynamic pressure of moving air adversely affecting the measurements.

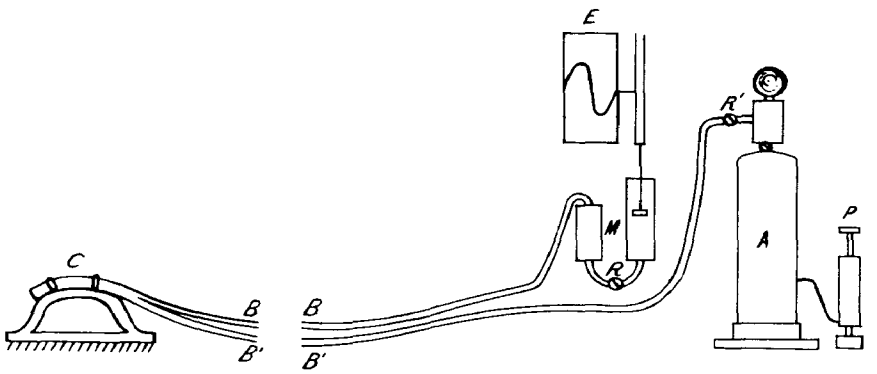
We are pleased to note that the Coast and Geodetic Survey has revived a very interesting and well established principle, and that by the well chosen application of progress in technical instrumentation it has been possible to develop an instrument which lends itself to many uses.

APPENDIX

Extract from the work *Observation, étude et prédiction des marées* by M. ROLLET DE L'ISLE, Paris, 1905

TIDE GAUGE OF THE MARITIME SERVICE OF THE GIRONDE

In order to record the tides at La Coubre the *Service des Ponts et Chaussées* of the Gironde region a year ago put into service a pressure tide gauge based on a slightly different principle from those previously used. (Figure 1).



The receiving apparatus is made up of a Tube C, of 0.60 m in length and 3 centimetres in diameter, fixed to the bottom of the sea : is is open at one end, and at the other communicates by means of two tubes B and B′, of 3 millimetres in diameter, with the registering apparatus.

The tube B ends in a Mercury Pressure Gauge M which has on one of its branches a float which moves up and down and these movements are transmitted to a stylus which traces the curve on the recording cylinder E.

The tube B′ communicates with an air container which is connected to the Reservoir A containing air under pressure. By means of the cock R′ the arrival of air at the end of tube C can be regulated in such a way that this air escapes bubble by bubble : under these conditions the pressure at this point is always equal to the atmospheric pressure increased by the pressure exerted by the height of the water above C.

It can be concluded therefore that the variations in the height of the tide are recorded on E.

This apparatus has given very good results. The curves are well defined and moreover the effect of swell can be attenuated by opening the cock to a greater or lesser extent : the outflow of air does not exceed 500 litres per day : the reservoir A is re-charged once a day by means of the manual pump P.