

and stars." It can not at present be decided whether, at the close of the fifteenth century, the use of the log was known as a means of estimating the distance traversed while the direction is indicated by the compass; but it is certain that Pigafetta, the companion of Magellan, speaks of the log (*la catena a poppa*) as of a well-known means of measuring the course passed over.\*

\* In all the writings on the art of navigation which I have examined, I have found the erroneous opinion that the log for the measurement of the distance traversed was not used before the end of the sixteenth or the beginning of the seventeenth century. In the *Encyclopædia Britannica* (seventh edition, 1842), vol. xiii., p. 416, it is further stated, "The author of the device for measuring the ship's way is not known, and no mention of it occurs till the year 1607, in an East Indian voyage published by Purchas." This year is also named in all earlier and later dictionaries as the extreme limit (Gehler, *bd. vi.*, 1831, s. 450). Navarrete alone, in the *Dissertacion sobre los Progresos del Arte de Navegar*, 1802, places the use of the log-line in English ships in the year 1577. (Duffot de Mofras, *Notice Biographique sur Mendoza et Navarrete*, 1845, p. 64.) Subsequently, in another place (*Coleccion de los Viages de los Españoles*, t. iv., 1837, p. 97), he asserts that, "in Magellan's time, the speed of the ship was only estimated by the eye (*à ojo*), until, in the sixteenth century, the *corredera* (the log) was devised." The measurement of the distance sailed over by means of throwing the log, although this means must, in itself, be termed imperfect, has become of such great importance toward a knowledge of the velocity and direction of oceanic currents, that I have been led to make it an object of careful investigation. I here give the principal results which are contained in the sixth (still unpublished) volume of my *Examen Critique de l'Histoire de la Géographie et des Progrès de l'Astronomie Nautique*. The Romans, in the time of the republic, had in their ships *way-measurers*, which consisted of wheels four feet high, provided with paddles attached to the outside of the ship, exactly as in our steam-boats, and as in the apparatus for propelling vessels, which Blasco de Garay had proposed, in 1543, at Barcelona to the Emperor Charles V. (Arago, *Annuaire du Bur. des Long.*, 1829, p. 152.) The ancient Roman way-measurer (*ratio a majoribus tradita, qua in via rheda sedentes vel mari navigantes scire possumus quot millia numero itineris fecerimus*) is described in detail by Vitruvius (*lib. x.*, cap. 14), the credit of whose Augustan antiquity has indeed been recently much shaken by C. Schultz and Osann. By means of three-toothed wheels acting on each other, and by the falling of small round stones from a wheel-case (*loculamentum*) having only a single opening, the number of revolutions of the outside wheels which dipped in the sea, and the number of miles passed over in the day's voyage, were given. Vitruvius does not say whether these *hodometers*, which might afford "both use and pleasure," were much used in the Mediterranean. In the biography of the Emperor Pertinax by Julius Capitolinus, mention is made of the sale of the effects left by the Emperor Commodus, among which was a traveling carriage provided with a similar *hodometric* apparatus (cap. 8 in *Hist. Augustæ Script.*, ed. Lugd. Bat., 1671, t. i., p. 554). The wheels indicated both "the measure of the distance passed over, and the dura