Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Dutch Pendulum Observations in Submarines.

IN the letter from Mr. Bowie on the subject of Dr. F. A. Vening Meinesz's pendulum observations on board a submarine, which appeared in NATURE of December 27, 1924, p. 930, there is a passage which seems to me to suggest a wrong idea of Dr. Meinesz's method and thereby perhaps to engender doubts as to the possible accuracy of his results.

Mr. Bowie quotes the following pargraph from a paper which he presented at the Pan-Pacific Scientific Congress of 1920: "It is hoped that a satisfactory apparatus may be devised for determining the intensity of gravity at sea, using special vessels or commercial vessels. There are several types of apparatus in existence, but no one of them gives results of sufficient accuracy for the study of isostasy. The writer suggests that it may be possible to obtain a fair value of the intensity of gravity at sea by the use of the land apparatus properly mounted on a vessel. The apparatus would have to be swung in double gimbals and should be placed near the point of minimum translation resulting from the pitching and rolling of the vessel," and adds, "It was with great satisfaction that I read that Dr. Meinesz had accomplished the accurate determination of gravity at sea with the use of pendulums. No doubt he arrived at the conclusion that the pendulum could be used independently of my suggestion in 1920."

The passage gives the impression that Dr. Meinesz's method consists of so mounting the apparatus as to reduce the disturbance due to the pitching and rolling of the vessel to a negligible quantity. But this is not the method at all, and indeed one may reasonably doubt whether it would ever be possible to produce on board a ship a stillness at all comparable to that enjoyed by what the inhabitants doubtless consider the *terra firma* of the western part of Holland; yet in that region the instability of the ground is such that Dr. Meinesz found it impossible to obtain any result by means of the pendulum apparatus used in the ordinary way, as the disturbance of the time of oscillation of the pendulum caused by the movements of the ground was far too great. The same difficulty has been met by other observers in places where the conditions are similar to those found in western Holland.

To overcome this difficulty, Dr. Meinesz thought of the ingenious plan of swinging two pendulums simultaneously on the same stand. He showed by analysis that from observations of the times of swing of the two disturbed pendulums it was possible to deduce the time of swing of a hypothetical pendulum, the length of which is constant so long as those of the two real pendulums do not vary, and the time of swing of which is independent of the disturbances suffered by the real pendulums. The two pendulums are swung in the same plane and on the same support; that is to say, their knife-edges are parallel and the surfaces on which they swing are rigidly connected. The idea of the method, to state it quite roughly, is that the two pendulums suffer equal but opposite disturbances, so that a mean undisturbed value is deducible.

This method was found to give excellent results on the slightly unstable soil of Holland, and has also been found to give good results on a submarine where the instability, though much less than that of a ship floating on the surface, is nevertheless enormous compared with the least stable of the land stations.

I cannot believe that attempts to reduce the effects of a ship's movements by such devices as gimbals and the like would ever have been successful in freeing a pendulum, swinging by itself, from disturbances too great to be tolerable, but Dr. Meinesz introduces a new idea quite different from that of damping out the effects of the movements.

It is very desirable that the originality of Dr. Meinesz's method should be recognised and that he should have full credit as the sole inventor of a plan which seems to have solved the problem of the determination of gravity at sea.

G. P. LENOX-CONYNGHAM

Trinity College,
Cambridge, December 30.

On a Connexion between the Spectra of Argon and Ionised Potassium.

THE quantitative relations between the spectra of argon and ionised potassium have been for some time a subject of investigation in the Amsterdam Laboratory. The available observations are chiefly due to Schillinger (*Wiener Sitz. Ber.* 118, 605, 1909), McLennan (Proc. R.S., 100, 182, 1921), and Dik and Zeeman (*Proc. Kon. Acad. Amsterdam*, 1922, 1923). Schillinger used a spark for the production of the K^+ spectrum, McLennan, as well as Dik and Zeeman, the electrodeless discharge. Dik and Zeeman got a rather pure K^+ spectrum, because with very intense discharges the arc lines were entirely suppressed, a result at variance with that of other observers. The observations were obtained with a quartz spectrograph. The accuracy is, therefore, not sufficient for a scrutinising analysis, and observations with a grating spectrograph were projected.

Prof. Konen kindly informed us that in Bonn such measurements were already in hand, so that they were here postponed. From the preliminary observations, Dik and Zeeman concluded that, in the spectrum of ionised potassium, constant differences of about 847 and 1696 were present, and this would point to a connexion with the red spectrum of argon (Rydberg). Afterwards the present authors (De Bruin and Zeeman, NATURE, Sept. 6, 1924, p. 352) investigated the blue spectrum of argon (accurate measurements of Eder and Valenta), and it appeared that a difference of about 846 here is also characteristic, as well as about 414 also found with the spectrum of K^+. Afterwards we found that Paulson (*Astr. Journ.*, 41, p. 75, 1915) had also hit upon the difference of about 846 in argon. Recently, Dahmen (*Zeitschr. f. Phys.*, 29, 1924, p. 264), of Bonn, has published measurements on ionised potassium, using a large grating, and potassium electrodes in an atmosphere of argon. In his experiments the arc lines are not absent, but his results are far more accurate.

From an examination of this new material, we have come to the conclusion that the difference of about 847 is not characteristic and probably cannot be maintained. The difference of about 1696 is present, a more accurate value being about 1712. Instead of the difference of about 414, we now find 418·2 for ionised potassium.

We have found some groups of regularly distributed lines exhibiting also regular distribution of intensities, a fact of some importance for the further analysis, because the intensities are closely connected with the inner quantum numbers. In the "quintets," the second component has the greater intensity, surpassing