figure of the earth would indicate a greater value for the ellipticity. Amongst these perturbations there are four which have a somewhat considerable coefficient:

1. a motion of the perigee;
2. a motion of the nodes;
3. a periodic inequality in the longitude;
4. a periodic inequality in the latitude.

The first of these, according to our results, would lead to 1 : 294.3, according to NEWCOMB's to 1 : 294.6; the second, according to NEWCOMB's results, would yield 1 : 294.3 and the 4th, according to NEWCOMB, 1 : 293.7, while the 3rd which has a period of 18 years cannot be used for our purpose on account of the unexplained inequalities of long period in the mean longitude. Are these differences to be regarded as real and would therefore the measurements made on the surface of the earth not lead to an accurate determination of the difference in the moments of inertia?

On account of the possibility that other circumstances may exercise an influence upon the motions of the perigee and node, the periodic inequality in the latitude, which has a monthly period, would certainly be the most likely to yield a decisive answer to this question, if it were not that an error in the assumed obliquity of the ecliptic has precisely the same influence upon the declination of the moon as the inequality in the latitude. (See also NEWCOMB's very interesting Addendum to Chapter XI, p. 226).

Physics. — "*Magnetic researches.* XI. *Modification in the cryomagnetic apparatus of* KAMERLINGH ONNES *and* PERRIER." By Dr. E. OOSTERHUIS. Communication N°. 139*b* from the Physical Laboratory at Leiden. (Communicated by Prof. H. KAMERLINGH ONNES).

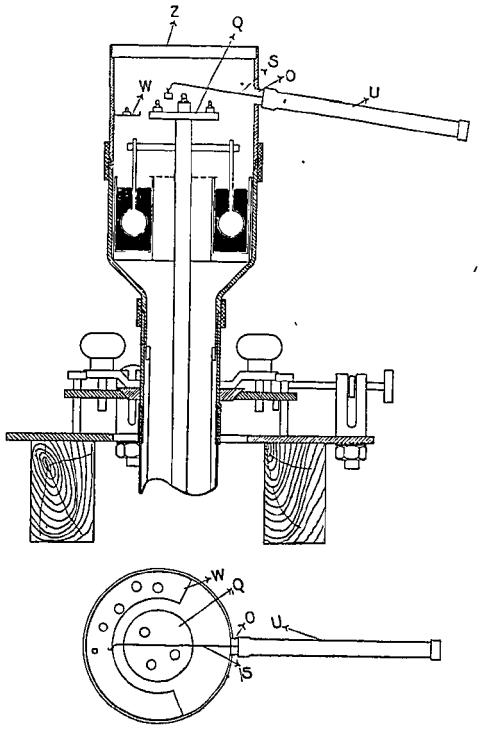
(Communicated in the meeting of January 31, 1914.)

In the researches on paramagnetism at low temperatures, described in N^{os}. VI, VII, and VIII of this series (Comm. N°. 129*b*, 132*e*, 134*d*), an apparatus was used, in the main the same as that constructed by KAMERLINGH ONNES and PERRIER, of which a complete description is found in Comm. N°. 139*a*.

In one particular, however, a change was made in the apparatus. The apparatus so changed, which was briefly indicated in § 1 of Comm. N°. 129*b*, is here more fully described. The force acting

upon the experimental substance in the tube, when it is placed in an inhomogeneous magnetic field, was measured in KAMERLINGH ONNES and PERRIER's apparatus by electro-magnetic compensation. This can be replaced with advantage by a compensation by means of weights, an opportunity for which is given by the scale Q placed upon the carrier [1]).

The hook S serves to move the weights on and off the scale, while the apparatus remains air-tight; it can be moved from the outside, through the opening O. The rubber tube U is hermetically attached to the rim of the opening O, and also to the extremity of the hook; in this way, the tube and the hook together can be moved sufficiently [2]) to be able to lift the weights from the wall table W and place them on the scale, or vice versâ. The glass plate Z enables these manipulations to be watched from the outside. To prevent the rubber tube collapsing when there is a partial vacuum in the apparatus, it is supported on the inside by a flexible spiral of steel wire. We further refer to the figures, in which the upper portion of the apparatus,



[1]) In the apparatus described in Comm. N°. 139a there was also a scale fixed at the top of the carrier; the weights placed upon it did not however serve to measure the force, but only to obtain an approximate equilibrium against the upward pressure of the liquid. (See § 3d Comm. N°. 139a).

[2]) Compare the similar arrangement for stirring in cryostats, Comm. N. 83 § 4.

as it appears after our modification, is shown in section and seen from above. The lower part remained unchanged [1]).

The arrangement here described has some advantages over that with the electro-magnetic compensation. In the first place, a much greater force S can be measured by it, and moreover the method of working is simpler, as now only one current (that of the electro-magnet) has to be read, in the earlier arrangement three. On the other hand, while in the former arrangement the current through the electro-magnet was adjusted to certain fixed values, for which the corresponding strengths of field were accurately measured, in the modified arrangement it is best to place a certain weight upon the scale, and to regulate the current through the electro-magnet, until this weight is exactly compensated by the force exerted upon the experimental substance by the magnetic field. As the strength of field corresponding to this current must now be found by (graphic) interpolation, it can now only be as accurately known as by the method described in Comm. N°. 139^a, if the field has been determined for a great number of current strengths. Naturally in the method of compensation by weights we could also work with a few accurately measured magnetic fields, if we had a sufficient number of small weights at our disposal inside the apparatus; but working in this way would greatly decrease the simplicity of the method. For this reason in these investigations by the method of compensation with weights, the field for the WEISS electro-magnet for different strengths of current, was very minutely studied.

Physics. — "*Magnetic researches.* XII. *The susceptibility of solid oxygen in two forms*". By ALBERT PERRIER *and* H. KAMERLINGH ONNES. Communication N° 139c from the Physical Laboratory at Leiden. (Communicated by Prof. H. KAMERLINGH ONNES.)

(Communicated in the meeting of January 31, 1914.)

§ 1. *Introduction.* A former investigation [2]) had led us to the conclusion that the susceptibility of oxygen suddenly becomes considerably smaller when this substance changes into the solid state.

[1]) The sectional drawing of the upper portion of the apparatus is drawn on the same scale as the fig. in Comm N°. 139a, and gives therefore, if placed upon that, the complete drawing of the apparatus as used in the researches of Comm. N°. 129b, 132e and 134d.

[2]) H. KAMERLINGH ONNES and ALBERT PERRIER, Leiden Comm. N°. 116 and 124a.