produced by the regenerative cascade. Enough but not too much, because for operations with liquid hydrogen (comp. X) and also for other experimentations in the realm of cryogenic work it is very important that we should dispose of such a relatively abundant stock of liquid air as is produced by the Leiden cascade.

XIV. *Preparation of pure hydrogen through distillation of less pure hydrogen.*

It was obvious that we could obtain pure hydrogen for the replenishment of the thermometers and piezometers [1]) when we distil liquid hydrogen at reduced pressure [2]), and then evaporate the very pure liquid thus obtained. Therefore the following apparatus has been constructed (fig. 5).

A vacuum glass A is connected with the liquefactor (see Pl. I and III at N_0) or with a storage bottle, exhausted and filled with liquid hydrogen as indicated in X § 7. Then C (exhausted beforehand) in the vacuum glass B is filled several times out of A, and the vacuum glass B is connected with B_1 to the liquefactor and exhausted like A and also filled with liquid hydrogen and connected with the ordinary airpump at B_2 so that the hydrogen boils in B at 60 m.m. Then hydrogen is distilled over along c_1 into the reservoir C, we

1) In Comm. N°. 94*e* (June '05) I have mentioned that a purification through compression combined with cooling might be useful in the case of hydrogen even after the latter in the generating apparatus (Comm. N°. 27, May '96 and N°. 60, Sept. 1900) had been led over phosphorous pentoxide. I said so especially with a view to the absorption of water vapour as, with due working, the gas — at least to an appreciable vapour tension — cannot contain anything but H_2O and SO_4H_2. How completely the water vapour can be freed in this manner appears from a calculation of Dr. W. H. KEESOM, for which he made use of the formula of SCHEEL (Verh. D. phys. Ges. 7, p. 391, 1905) and from which follows for the pressure of water vapour (above ice) at $-180°$ C. 10^{-18} mm., so that water is entirely held back if the gas remains long enough in the apparatus. This holds for all substances of which the boiling point is higher than that of water (SO_3 vapours, grease-vapours etc.). The operation is therefore also desirable to keep back these substances. As to a gas which is mixed only with water there will remain, when it is led in a stream of 3 liters per hour through a tube of 2 cm. in diameter and 8 cm. in length over phosphorous pentoxide, no more than 1 m.gr. impurity per 40000 liters (MORLEY, Amer. Journ. of Sc. (3) 34 p. 149, 1887). This quantity of 1 m.gr. is probably only for a small part water (MORLEY, Journ. de chim. phys. 3, p. 241, 1905). Therefore the operation mentioned would not be absolutely necessary at least with regard to water vapour when a sufficient contact with the phosphorous pentoxide were ensured. But in this way the uncertainty, which remains on this point, is removed.

2) This application follows obviously from what has been suggested by DEWAR, Proc. Chem. Soc. 15, p. 71, 1899.

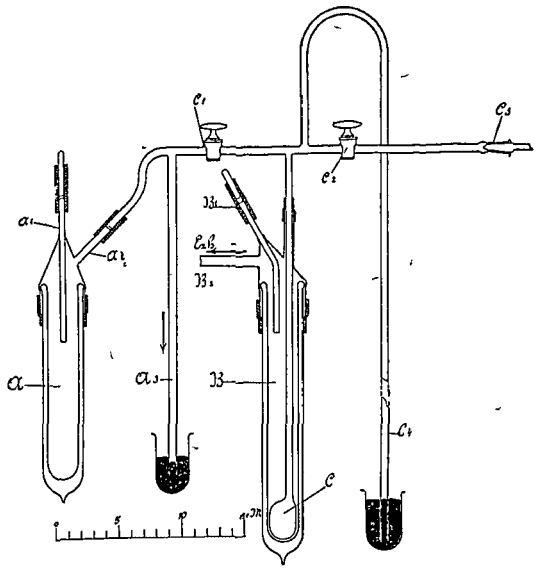

Fig. 5.

shut c_1 and disconnect the india rubber tube at a and remove the whole apparatus to the measuring apparatus which is to be filled with pure hydrogen; to this end the apparatus is connected with the mercury pump, intended for this purpose, at c_3. To take care that the hydrogen in B should evaporate but slowly and the quantity in C should not be lost before we begin to fill the pieces of apparatus, B is placed in a vacuum glass with liquid air.

Physics. — "*On the measurement of very low temperatures.* IX. *Comparison of a thermo-element constantin-steel with the hydrogen thermometer.*" By Prof. H. KAMERLINGH ONNES and C. A. CROMMELIN. Communication N° 95^a from the Physical Laboratory at Leiden.

(Communicated in the meeting of June 30, 1906).

§ 1. *Introduction.* The measurements communicated in this paper form part of a series, which was undertaken long ago with a view to obtain data about the trustworthiness of the determination of low temperatures which are as far as possible independent and intercomparable. Therefore the plan had been made to compare a thermo-element[1]), a gold- and a platinum-resistance thermometer[2])

[1]) Comp. comms. N°. 27 and 89. (Proc. Roy. Ac. May 1896, June 1896, and Feb. 1904).

[2]) Comp. comms. N°. 77 and 93. (Idem Febr. 1902 and Oct. 1904).