graphs in the infra-red Wood's filters are used, made by Wratten and Wainwright; the preparation of these plates is described. The method for determining the absorption of the light by the soil is not explained at all. Eight pairs of photographs are reproduced showing the darkening of the plates by ultra-violet and by infra-red light, in each case by four soils (calcareous, sandy, clay, humus), in the dry or humid state. The dry soil absorbed much less infra-red light than the humid soil; this effect of moisture, which was most marked in the case of clay soil, was much less noticeable in the case of ultra-violet light.—*H. B[orns]*.

DENSITY OF OXYGEN.[1]

By A. F. O. GERMANN.

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This paper contains, first of all, a historical survey of the determinations of the density of oxygen, and a description of the special apparatus employed. As a result of his determinations with oxygen, prepared by heating potassium permanganate and purified by liquefaction and fractional distillation, the author obtains the value for the weight of a normal liter of oxygen (at 0°C. and under a pressure of 760 mm. of mercury in latitude 45° at sea-level), of 1.42906 gm. Taking into account the previous determinations of Morley and of Rayleigh, but giving rather more weight to his own determination, the author believes that the most probable value for the weight of a normal liter of oxygen, $L_N = 1.42905$ gm.—*A. Fi[ndlay]*.

ORDINARY AND INTERNAL SEICHES IN LAKE TASAWA.[2]

By K. HONDA.

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As in previous investigations, the author constructed a model of this the deepest Japanese lake before making the actual observations, and found experimentally four periods for the fundamental and higher modes of oscillations. Generally speaking, the seiches are most conspicuous in deep lakes, and seldom observable in shallow, but here only faint undulations were detected, using Honda's limnimeters for this purpose. The following causes are given for these inconspicuous seiches in such a deep lake: (1) The form of the lake being nearly circular there is no direction of easy oscillation; (2) surrounded on all sides by steep mountains the lake is generally very calm; (3) the depth being so great, a strong exciting cause is required to make the whole water oscillate.

For the observation of the internal seiches, a Miller pattern deep-sea thermometer, which indicates the maximum and minimum temperatures, was used. An adequate description of the operations is given and the following results obtained: Near the surface the fall of temperature is gradual, but at a depth from 10 to 16 meters is very rapid; afterward it becomes again very slow, tending asymptotically to the temperature of the maximum density of water, 4°C. The usual explanation for the existence of this apparent discontinuous layer is that near the surface the temperature is equalized by the disturbing effect of currents and the waves in the lake. The depth to which the disturbance reaches depends upon its duration, increasing with the period of disturbances. Down to this depth the fall of temperature is very gradual, but the conduction of heat being very small, the fall of temperature in a depth deeper than that where the disturbance nearly vanishes follows a logarithmic law with respect to the depth. Hence the fall is at first very gradual, then very rapid, and afterward becomes more and more slow, so that there is an apparent layer of discontinuity. Similar results are given for the lakes of Inawasiro and Towada. Tables of observations are given, and from the curves (temperature-time for constant depths and depth-time for constant temperatures) two periods are deduced for the approximate values of periods of internal seiches. A short mathematical discussion concludes the paper from which it follows that the two long periods recorded on the limnimeters are due to the internal seiches of the lake. Hitherto in the observations of the ordinary seiches, where the periods are large compared with the natural oscillations of the lakes, these are usually attributed to the effect of wind blowing with some periodicity of slow alternations. From the present investigation, however, the long periods are well explained by the internal seiches of the lakes.—*H. H. Ho[dgson]*.

ÆOLIAN TONES.[1]

By LORD RAYLEIGH.

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In what has long been known as the æolian harp, a stretched string, such as a pianoforte wire or a violin string, is caused to vibrate in one of its possible modes by the impact of wind; and it was usually supposed that the action was analogous to that of a violin bow, so that the vibrations were executed in the plane containing the direction of the wind. A closer examination showed, however, that this opinion was erroneous and that in fact the vibrations are transverse to the wind. Further, it is not essential to the production of sound that the string should take part in the vibration, and the general phenomenon, exemplified in the whistling of wind among trees has been investigated by Strouhal (1878) under the name of *Reibungstöne* [friction tones]. In Strouhal's experiments a vertical wire or rod attached to a suitable frame was caused to revolve with uniform velocity about a parallel axis. The pitch of the æolian tone generated by the relative motion of the wire and of the air was found to be independent of the length and of the tension of the wire, but to vary with the wire's diameter, D, and with the speed, V, of the motion. Within certain limits the relation between the frequency, N, and these data was expressible by

$$N = 0.185\ V \div D \quad . \ . \ . \ (1),$$

the centimeter and the second being units.

Other refinements are here considered and finally the following formula is given:

$$ND/V = 0.195\ (1 - 20.1\nu/VD),$$

where for air at about 20°C. the kinetic viscosity is $\nu = \mu/\rho = 1806 \times 10^{-7}/0.00120 = 0.1505$ c. g. s. For water at 15°C., $\nu = 0.0115$.

The formation of vortices in the fluid flowing past the wires is discussed and some preliminary experiments are described.

Further experiments are still, however, admittedly desirable.—*E. H. B[arton]*.

[1] *See* J. Phys. chem., June 19, 1915, p. 437-477.
[2] *See* Tôhoku Univ., Sci. Reports, 1915, p. 33-42.

[1] *See* Phil. mag., April, 1915, p. 433-444.