$K_2S_2O_8$, with 2 to 3 per cent. KOH. The persulphate is hydrolysed, according to the equation

$$K_2S_2O_8 + H_2O = 2KHSO_4 + O. \quad . \quad . \quad (1)$$

The excess alkali neutralises the acid salt and prevents the solution from becoming acid. Investigations on the velocity of decomposition of persulphate solutions (Green and Masson, J.C.S., 1910, 97, 2086; S. E. Sheppard, *Phot. Jour.*, 1921, 61, p. 454; G. I. Higson, J.C.S., 1921, 119, p. 2048) have shown that the reaction is monomolecular with regard to persulphate, so that equation (1) probably represents the course of the reaction, and atomic oxygen is liberated. The initial production of atomic oxygen is in agreement with the oxidation potential of persulphate solutions.

The simplest representation of the blackening of copper by persulphate would be

$$Cu + O \longrightarrow CuO, \quad . \quad . \quad . \quad (2)$$

but this undoubtedly only represents the initial and final results. That a more complex process occurs appears to be indicated by the structure of the oxide layer. This is formed as a soft velvety pile, which is not removed by gentle rubbing, but consolidates to a smooth and semi-lustrous layer. A further refinement of the oxidation process is to suppose that cuprous oxide is first formed; it has already been pointed out that the lattice structure of cuprous oxide is nearer that of copper metal than is that of cupric oxide. Hence we may write

$$Cu_2 + O \longrightarrow Cu_2O + O \longrightarrow 2CuO. \quad . \quad (3)$$

When the metal is slowly lowered into the persulphate solution, it is exposed for a longer time to the air: solution interface. This is the only difference in condition in the two cases. It appeared to me that concentration of molecular oxygen in this layer might be causing the interference. Protection of the surface, as by holding a glass rod against it, while passing the interface, was enough to remove the interference, the protected part blackening normally. Again, if a little antoxidising solution, as hydroquinone-sulphite of soda, were allowed to trickle over the metal just as it entered the persulphate solution, the blackening was of course at first delayed, but soon took place with full vigour. Finally, electrolytic generation of hydrogen at the interface also overcame the interference.

Molecular oxygen is of course accumulating at the interface from the discharge of $O + O \longrightarrow O_2$ produced by the hydrolysis of the persulphate. My tentative explanation of the oxygen interference was that cuprous peroxide is formed:

$$Cu_2O + O_2 \longrightarrow Cu_2O_3, \quad . \quad . \quad . \quad (4)$$

and that this paralyses the reaction, a passive layer being formed.

In line with Mouren's work, it may be possible that both cuprous and cupric peroxides are formed:

$$\begin{aligned} Cu_2O + O_2 &\longrightarrow Cu_2O_3, \\ CuO + O_2 &\longrightarrow CuO_3, \quad . \quad . \quad . \quad (5) \end{aligned}$$

and that these decompose each other, with mutual reduction:

$$Cu_2O_3 + CuO_3 \longrightarrow 3Cu + 3O_2. \quad . \quad . \quad (6)$$

Be that as it may, the facts appear to demonstrate another case of the impedance of oxidation by oxygen.

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The Adult Form of the "Harvest Bug."

THE adult form of the larval mite known as the "Harvest Bug" (*Leptus autumnalis* Shaw), which causes so much annoyance in many rural districts at this time of the year, has long been sought for. In the middle of August, Prof. F. V. Theobald and Mr. C. W. Goode, of Wye, sent me three chickens heavily infested with this larval mite. From these larvæ I have succeeded in rearing an adult mite closely allied to Trombicula, Berlese, and resembling that genus in having a deep constriction behind the anterior pairs of legs, but more elongated in form and with the setæ on the cephalothorax shorter and differently shaped. I propose the name *Trombicula* (*Neotrombicula*) *autumnale* for this adult mite, Neotrombicula being a new subgeneric name. The name Leptus was created by Latreille for *Acarus phalangi* (= *Achorolophus ignotus* Oudmns), now referred to the family Erythræidæ, and should not be used for the "harvest bug," which belongs to the family Trombidiidæ.

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Gibbs' Phenomenon in Fourier's Integrals.

PROF. CARSLAW has raised, in NATURE of August 29, p. 312, a point which has been interesting me during the past few months. In addition to the case of Fourier's integral which he cites, I have noticed that Hankel's integral

$$f(x) = \int_0^\infty J_\nu(xu)u\,du \int_0^\infty J_\nu(tu)tf(t)dt,$$

and Titchmarsh's integral [1]

$$f(x) = \int_0^\infty \mathbf{H}_\nu(xu)u\,du \int_0^\infty Y_\nu(tu)tf(t)dt,$$

where $\mathbf{H}_\nu(z)$ is Struve's function, possess Gibbs' phenomena at points of discontinuity.

This can be shown by a method similar to that given by Prof. Carslaw, using the asymptotic forms for the functions concerned where necessary.

I may add that in the case of Hankel's integral this throws considerable light on the similar problem in the case of Fourier-Bessel series.

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The "Kennelly-Heaviside" Layer.

EVERY radio engineer is familiar with what is called the "Heaviside Layer" and its supposed functions. I find, however, that the hypothesis of an electrically conducting stratum in the upper air was clearly enunciated in an article by Prof. A. E. Kennelly, of Harvard University, published in the *Electrical World and Engineer* of New York on March 15, 1902. The official date of Heaviside's disclosure of his hypothesis is December 19, 1902. About the same date H. Poincaré, A. Blondel, and C. E. Guillaume made similar hypotheses. If names are to be attached to this hypothetical layer it should be called, in equity, the "Kennelly-Heaviside" layer, a name which is beginning to be used in America.

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[1] E. C. Titchmarsh, "Extensions of Fourier's Integral Formula to formulae involving Bessel Functions," Proc. London Math. Soc. (2), 23 (1925), xxii. (Records for Jan. 17, 1924.)

operation the relay principle has worked out to the advantage of all the interconnected companies, and little, if any, benefit would be derived by erecting a superstructure of long high-voltage lines in the territory. Future progress seems to lie in the direction of making possible more relay interconnections and the erection of a substructure distribution network so as to tap the 110-kv. network at important load centers only.

Applications of the relay principle to other properties in other territories might well be studied carefully in connection with projects for erecting a "super" line to take advantage of diversity or to give service insurance. Normally inoperative investments should be avoided if possible.

The Kennelly-Heaviside Layer

RECENT experimental investigations in radio telegraphy, concerning the relations between distance of transmission and wave length, have caused increasing speculation as to the properties of the conducting layer long suspected to exist in the outer atmosphere of the earth. This layer is often spoken of as the "Heaviside layer." The association of the name of the great English mathematician is probably due, first, to his suggestion of the importance of such a layer, in his article on "Telegraphy" in the Encyclopædia Britannica, and, second, to his extensive mathematical analysis of electromagnetic wave propagation. It is worth noting, however, that Heaviside was not the first to refer to a probable electrical conductivity in the upper layers of the earth's atmosphere.

Even before Marconi's practical development of a method of signal transmission, based on Hertz's great discoveries, J. J. Thomson had pointed out the increased conductivity of air at very low pressures, and it was realized generally that such conductivity must necessarily exist in the low-pressure regions of the upper atmosphere. This idea was immediately seized upon by geophysicists as a possible factor in such terrestrial phenomena as the aurora and the earth's magnetism. Balfour Stewart in 1882 suggested that the motion of large bodies of air through the magnetic field of the earth might account for the diurnal variations of the earth's magnetic field, provided that the air possessed electrical conductivity. Schuster, in 1887, having shown that a source of ionization renders the neighboring air conducting, proved that the diurnal magnetic variation could not be due to forces inside the earth but might be due to currents outside, that is, in the upper atmosphere, if an ionizing source were present.

The discovery of wireless telegraphy and radio transmission about the curvature of the earth soon developed a new importance for the upper conducting air as a reflecting medium for electromagnetic waves. Apparently the first scientist to call public attention to its importance and to outline the influence which it should have in wireless transmission was A. E. Kennelly in an article in the ELECTRICAL WORLD of March 15, 1902. Heaviside's brief and somewhat casual comment appeared a few months later in the article referred to above. Heaviside's numerous contributions contain analyses of the transmission and reflection of electromagnetic waves in their relation to many shapes of conducting surface, including that of reflection from a plane. The combination has apparently been sufficient to start a widespread impression that he was the first to suggest the importance of the upper conducting layer as a factor in radio transmission. In view of the facts outlined above, however, it would appear that while the existence of such a conducting layer was recognized even before the discovery of radio telegraphy, the first public suggestion of its importance in the latter great field is due to Kennelly. On the other hand, the announcement of Heaviside followed so closely, and his studies of the reflection of electromagnetic waves were so extensive, that it would appear that the names of both of these distinguished scientists should be associated with the conducting layer. If this estimate of the relative values of the facts is correct, it would therefore be eminently proper in speaking of the upper conducting layer to call it the "Kennelly-Heaviside layer."

Economy of Purchased Power

THE fact that fifty-two out of fifty-eight of the hotels in Chicago now purchase power in preference to operating private plants serves as a practical demonstration of the superiority and economy of central-station service. In the last ten years every new Chicago hotel has contracted for purchased power and none has installed a private plant. Such a record bespeaks the efficiency of the Commonwealth Edison Company's power sales department and represents the cumulative effect of a good many years' patient missionary work.

The value of the space required for a private power plant, high interest and depreciation charges against this equipment, which does not contribute to the hotel's earning capacity, and a correct appraisal of the relative steam requirements for building heating and power and light have been the principal determining influences in all of these Chicago hotel installations. These same factors in varying degrees exist wherever power and light are used, whether it is a commercial or industrial operation, and where a careful and honest analysis of conditions is made the economy of purchased power becomes evident. The experience of the fifty-two Chicago hotels leads to the definite conclusion that it is far cheaper to buy power than to make it.

Obsolete Lighting Fixtures Are Still Numerous in Homes

LIGHTING experts are not in sympathy with certain trends in fixture design evident in recent years, although improvement is manifest by the tendency to install shades on fixtures. However, quite aside from the question of the satisfactoriness of modern fixtures, there is still a startlingly high percentage of obviously obsolete fixtures in use in this country at the present time. A recent extensive survey by M. Luckiesh indicates that one-third of the ceiling fixtures in use in the homes are unquestionably obsolete. The percentage of obsolete ceiling fixtures in living rooms and dining rooms is about 16 per cent, in bedrooms and bathrooms about 52 per cent and in kitchens about 63 per cent. Even to those who follow lighting development very closely these seem astonishing percentages. The replacement of these fixtures with modern ones of very moderate cost means a total business in fixtures of about two hundred million dollars. In a city of three hundred thousand population there is a total business in fixtures