rector, Vol. II, Part VIII. On the Collection of Cavern Insects. By Elzéar Abeille de Perrin, University Press, Cambridge, 1877." This apparently rare paper consists of pages 1 to 14, without illustrations. Though numbered VIII, it was evidently published, 1877, before Lucien Carr's paper, which Jillson calls number I, but which was not published until 1883.

These two papers, Lucien Carr's, No. I, and Abeille de Perrin's, No. VIII, as far as I can ascertain, were the only ones ever published in Vol. II of the *Memoirs* of the Kentucky Survey. The same conclusion is expressed by Adelaide R. Haase, on page 305 of "Index of Economic Material in Documents of the States of the United States," Kentucky, 1792–1904, Publication 85, Carnegie Institution of Washington, 1910. I would further say that apparently none of the seven papers announced for Vol. II of the Kentucky Survey as above listed was ever published, at least as there recorded.

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IONS AND ELECTRICAL CURRENTS IN THE UPPER ATMOSPHERE

IN a paper to be communicated to the American Physical Society it is assumed that the ionization in the upper atmosphere is caused by the ultra-violet light of the sun and that the ion and electron densities at noon at the equator are those required by the theory of wireless wave propagation. From the laws of recombination of the ions and the diffusion and drift of the ions in the earth's magnetic and gravitational fields the distribution of the ions over the earth is worked out. This distribution turns out to be that required by the diamagnetic theory of the solar diurnal variation of the earth's magnetism. The gravitational drift currents are found to flow mainly along the parallels of latitude in the following way: on the daylight hemisphere (1) a current sheet flowing eastward in the levels above 150 km which at the sunrise and sunset longitudes divides into two sheets; (2) one of these flows westward on the day side of the earth underneath (1) in the levels below 150 km, and (3) the other sheet continues eastward in the upper levels around on the night side of the earth. The current is mainly between the fortieth parallels of latitude, north and south, and falls to lower values at the higher latitudes. The total currents in the three sheets are about 10^7, 8×10^6 and 2×10^6 amperes, respectively. The east and west daytime current sheets subtract from each other leaving in effect an eastward current of about 2×10^6 amperes flowing around the earth all the time. This causes a magnetic field agreeing in magnitude and type with that obtained by Bauer in his 1922 analysis of the magnetic field of the earth of external origin.

As a result of the drift currents, the sunset longitude of the earth is at a potential of several hundred volts above that of the sunrise longitude. This electric field combined with the earth's magnetic field causes the ions and electrons on the night side of the earth to drift upward with velocities of order 10^2 cm sec^{-1}. The ions and electrons move into regions of lower pressure and therefore do not recombine as fast as they otherwise would. This removes a difficulty from an earlier calculation which yielded too great a night-time rate of disappearance of the free charges. The upward drift of the ionization causes a rise of the Kennelly-Heaviside layer which is, partially at least, compensated by the fall due to the cooling and contraction of the atmosphere at night, and is complicated by the diffusion of the ions. It is difficult to say how much of the night-time rise of the layer observed in experiments with wireless rays may be genuine rise and how much may be an apparent rise due to delayed group velocities, or to other causes.

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MUYBRIDGE ANIMAL PICTURES

PROBABLY there are a good many individuals who for historic, scientific or for artistic purposes would be glad to secure samples of the Muybridge Locomotion Plates published under the auspices of the University of Pennsylvania in 1887. The complete work comprised 781 plates; each plate contains from twelve to thirty-six individual pictures, that is, from one to three series representing as many different photographic angles. A series represents some act of motor coordination, such as taking a step, jumping, striking with a hammer, etc. Recently the writer discovered that the remainders of these plates are in the hands of the Commercial Museum, 34th Street, Philadelphia. Not all the plates are represented in these remainders, but probably there are copies of some 350 or 400 of the subjects. These include men, women and children, nude and draped, and a very large animal series. In the latter the action portrayed is usually that of locomotion. The plates are in excellent condition, having remained in their original wrappers during the forty years of storage. On these plates the pictures are larger and present more detail than in the bound volumes of pictures which were issued by Muybridge. The Muybridge plates are still preeminent in the field which they cover and are of great value for their faithful representation of both