Abstracts of Bell System Technical Papers Not Appearing in this Journal

Thermal Agitation in Conductors.[1] H. NYQUIST. At the December, 1926, meeting of the American Physical Society, J. B. Johnson reported the discovery and measurement of an e.m.f. due to the thermal agitation in conductors. The present paper outlines a theoretical derivation of this effect. A non-dissipative transmission line is brought into thermodynamic equilibrium with conductors of a definite temperature. The line is then isolated and its energy investigated statistically. The resultant formula is $E_\nu^2 d\nu = 4kTRd\nu$ for the r.m.s. e.m.f. E_ν contributed in a frequency range one cycle wide by a network whose resistance component at the frequency ν is R. T and k are the absolute temperature and the Boltzmann constant. Experimental data are available for the audible range and there the agreement between the formula and the data is good. It will be observed that neither the charge nor mass nor any other property of the carrier of electricity enters the formula explicitly. They enter indirectly through R. The formula above is based on the equipartition law. If the quantum distribution law is used, the expression becomes

$$E_\nu^2 d\nu = [4h\nu R/(e^{h\nu/kT} - 1)]d\nu.$$

The two expressions are indistinguishable in the range of the measurements.

Light Waves in Metals.[2] THORNTON C. FRY. When a wave of plane polarized light falls obliquely upon a conducting surface, it gives rise to a disturbance inside the conductor which has, among others, the following peculiarities:

(*a*) It is neither plane nor elliptically polarized, but belongs to a third distinct category;

(*b*) It does not travel with what is customarily called "the speed of light";

(*c*) Its velocity varies with the angle of incidence.

There are similar light waves in dielectrics and in free space.

Transatlantic Telephony.[3] F. B. JEWETT. This paper discusses in rather popular terms some of the outstanding problems which

[1] *Phys. Rev.*, Vol. 29, p. 614, April, 1927.

[2] *Opt. Soc. Amer. Jl.*, Vol. 14, p. 473, June, 1927.

[3] *Scientific Monthly*, August, 1927.

were met and solved in the course of the development of commercial transatlantic telephony. The discussion covers the use of single side band transmission, directive receiving antennæ and voice-operated relays which permit of two-way operation upon a single wave-length. The possibilities brought to light by the extended study of receiving conditions are also described.

Some Possibilities and Limitations in Common Frequency Broadcasting.[4] DeLoss K. Martin, Glenn D. Gillett, Isabel S. Bemis. Radio broadcast stations assigned to transmit on the same carrier frequency may cause audible beat notes to be produced when their signals are received simultaneously, due to the inaccuracies in the frequency adjustments of the transmitters. The radio broadcast transmission results that might be obtained from two or more stations transmitting on the same frequency with sufficient accuracy in frequency adjustment to eliminate audio-frequency beat notes are presented briefly in this paper.

Two cases are considered, the first case where there is a difference in frequency of a few cycles and the second case where the frequency of the carrier signal for all stations transmitting on the same frequency is determined by a common oscillator.

The results of preliminary experimental tests with the signals from a station in New York City and a station in Washington, D. C., are given.

[4] *Proceeding Institute of Radio Engineers*, Vol. 15, Number 3, p. 213, March, 1927