# Abstracts of Bell System Technical Papers Not Appearing in the Bell System Technical Journal

*The Auditory Masking of One Pure Tone By Another and Its Probable Relation to the Dynamics of the Inner Ear.*[1] R. L. WEGEL and C. E. LANE. The authors used an air damped telephone receiver supplied with variable currents of two frequencies and determined the amount of masking by tones of frequency 200 to 3500 for frequencies from 150 to 5000. Except when the frequencies are so close together as to produce beats the masking is greatest for tones nearly alike. When the masking tone is loud it masks tones of higher frequency better than those of frequency lower than itself. If the masking tone is introduced into the opposite ear the effect occurs only by virtue of conduction through the bones of the head.

It is shown that combinational tones result when two tones of sufficient intensity are introduced simultaneously, these combinational tones being due to a non-linear response of the ear.

A dynamical theory of the cochlea is given which ascribes pitch discrimination to a passing of vibrations along the basilar membrane and a shunting through narrow regions of the membrane at points depending on the frequency. This view of the action of the ear offers an explanation of the masking effects.

*Distribution of Radio Waves from Broadcasting Stations over City Districts.*[2] RALPH BOWN and G. D. GILLETT. This is a description and analysis of the results obtained in a radio transmission survey of the cities of New York and Washington, D. C., and contiguous territory. Measurements of the field strength of radio signals from stations WCAP at Washington and WEAF at New York were made at a large number of points. Based on these data, curves are drawn showing how different kinds of territory cause different attenuations and showing radio shadows caused by mountains and by large masses of steel buildings. In order to visualize the phenomena, the data have also been plotted on maps, contour lines of equal signal strength being drawn. These contour maps illustrate graphically the non-uniformity of transmission in city areas and show the nature and extent of the "dead spots" and shadows.

[1] *Physical Review*, II, Vol. XXIII, p. 266, 1924.

[2] Presented to the Institute of Radio Engineers, January 16, 1924, at New York.

*Measuring Methods for Maintaining the Transmission Efficiency of Telephone Circuits.*[1] F. H. BEST. The circuits involved in the transmission of speech in a modern telephone plant, particularly those designed for long distance operation, necessarily involve a considerable amount of complexity. The use of telephone repeaters the development of long toll cables, the application of carrier systems and other developments associated with these, while increasing the efficiency and economy of telephone toll circuits have also increased their complexity and have required the development of more effective means of insuring that the circuits are maintained at all times in good condition and adjustment.

Maintenance of the transmission efficiency of the telephone plant is conducted by a special force, using methods and apparatus that have been developed for this purpose. This paper gives a brief description of the transmission characteristics of some of the common type of telephone circuits, outlines a general method for measuring their transmission efficiency and describes several of the most modern types of transmission measuring sets, together with a brief, mention of the oscillators which supply the power for testing.

*A Primary Standard of Light Following the Proposal of Waidner and Burgess.*[2] HERBERT E. IVES. The primary standard of light proposed in this paper consists of a black body constructed of platinum; the light from which, at its melting point, constitutes the photometric fixed point desired. The platinum black body consists of a cylinder of highly polished platinum with a narrow slit for observing the interior. Studies of the optical properties of reflecting cylindrical enclosures show that at certain angles of observation the interior is practically "black." The platinum cylinders are heated electrically and the light from the interior is observed by throwing an image of the slit on to a photometer field. Two series of observations were made, one by a visual photometric method, the other by a photoelectric cell giving a photographic record by means of a string electrometer. The two methods of observation gave practically identical results, yielding a final value for the brightness of the black body at the melting point of platinum of 55.4 candle power per square centimeter. The advantages of this proposed standard over the present unsatisfactory flame standards are discussed.

*High Quality Transmission and Reproduction of Speech and Music,*[3] W. H. MARTIN and HARVEY FLETCHER. Radio broadcasting has

[1] Journ. A. I. E. E. Vol. XLIII, p. 136, 1924.
[2] *Journal Franklin Institute*, Vol. 197, p. 147, p. 359, 1924.
[3] Journ. A. I. E. E. Vol. XLIII, p. 230, 1924.

drawn attention to the problems involved in obtaining high quality in systems for the electrical transmission and reproduction of sound. This paper gives the general requirements for such systems, discusses briefly the factors to be considered in design and operation and indicates to what extent the desired results can be obtained with the means now available.

It was pointed out in this paper that broadcasting stations and connecting lines can be made practically perfect but that most of the loud speaking apparatus now extensively used for reproduction, causes distortion. At the time of reading this paper the authors demonstrated a laboratory model of a new loud speaker of unusual design. This apparatus reproduces all frequencies from the lowest to the highest of the audible range with approximately equal facility. This results in reproduced music which the ear can scarcely distinguish from the original.

*Telephone Transformers.*[1] W. L. CASPER. After outlining the varied sets of conditions which different types of telephone transformers must meet, this paper discusses the design and construction of transformers to handle efficiently the range of frequencies ordinarily present in speech. Two winding transformers only are dealt with, and the three most common impedance combinations of the two circuits connected by the transformer are considered; namely, both circuits comprised of resistances, one circuit a resistance, and the other a positive reactance, and one circuit a resistance and the other a negative reactance.

The efficiency with which energy is transmitted is measured by comparison with an ideal transformer, and the transformer is studied by supposing it replaced by an equivalent T network. The variation of transformer losses with frequency is discussed and characteristic curves are shown for transformers of different mutual impedances. Characteristics are also given showing the operation of the in-put transformer associated with the vacuum tube.

The mechanical construction of the common battery repeating coil, telephone induction coil, and of certain types of transformers for vacuum tube circuits, are shown. These transformers are all constructed so as to give the desired accuracy of speech transmission under their respective circuit conditions.

*Radio Telephone Signaling—Low Frequency System.*[2] C. S. DEMAREST, M. L. ALMQUIST and L. M. CLEMENT. The system described

[1] Journal of the American Institute of Electrical Engineers, Vol. XLIII, p. 197, 1924.

[2] Journ. A. I. E. E. Vol. 43, p. 210, 1924.

provides a means whereby any one of about seventy-five radio stations, operating on the same wave length, may be called without signaling the remaining. Obviously this is an important improvement in the radio art for in many cases it permits a radio station operator to pursue other duties which would be impossible if he were required to listen in at all times.

The engineering problem presented, being remarkably similar to many telephone problems, was solved in a very similar manner. When it is desired to signal a station, an alternating current of a very definite frequency is impressed on the transmitter. This modulates the power radiated similar to the way the undulations of the voice modulate the power when speech is transmitted. The station to be signaled is determined by the code transmitted. This code consists of a definite grouping of dots and spaces and dashes.

At the receiving station this modulated power is detected in the usual manner and results in an alternating current identical in nature to that used in transmitting the code. A special alternating current relay of high selectivity and sensitivity, in conjuction with a more common direct current relay system, converts the code into a series of direct current impulses. These impulses pass into a selector like that used in common train dispatching circuits. The mechanism of this selector will be unlocked and a local ringing circuit closed if the code is that for which it has been set. Thus it is seen that the code is received by all stations but only one selector of the system will operate to ring its local annunciator bell. The number of stations which can operate in the same system is determined by the number of possible combinations on the selector. At present this is set at seventy-eight but this may be readily extended to include more than two hundred.

Because of the high selectivity of the alternating current relay and its associated direct current relay system, the apparatus is particularly free from interference such as the operation of nearby spark or I.C.W. Stations. In fact, tests show that the signaling system will continue to function satisfactorily long after interference is so bad as to make conversation impossible. As designed, the signaling system may be made an integral part of a standard radio system without altering the apparatus already in use.