

### Gramophone Records of Acoustic Analyses.

AT a meeting of the Physical Society of Sheffield held at the University of Sheffield on Feb. 11, a number of special gramophone records prepared in the Bell Telephone Laboratories, New York, to illustrate certain phenomena of hearing, were demonstrated by Dr. W. H. George. In the preparation of the original records the usual electrical process was used to convert the sound-waves by means of a microphone and amplifier into fluctuating electrical currents which, in passing through an electromagnetic recorder, operate the stylus cutting the 'wax'. In addition, electric filters could be switched into the circuit so as to eliminate effectively known frequency ranges.

Three of the records demonstrate the striking discovery of Fletcher (*Phys. Rev.*, 23, p. 427; 1924) that, contrary to the usual conception, the pitch of a musical sound is *not* necessarily that of the lowest component vibration. A single note (C = 256 vib. per sec.) is played successively upon a piano, a 'cello, and a French horn, and then the notes are repeated with the filters adjusted to eliminate the fundamental tone, then the fundamental and the first two overtones, and later all below the sixth or eleventh overtones. Although great differences in quality and intensity are apparent, the pitch of the notes heard remains the same. Quality differences sometimes make it difficult to decide if the pitch is middle C or one of its octaves. The experiments and results are repeated with the sung vowel Ah, with an organ pipe and with a clarinet, in which latter instrument the lower even overtones are very weak.

Low pass filters are used in another record to illustrate the effect on tone quality of removing the upper partials from the tones of a single note played upon a piano, 'cello, or French horn. The filters are adjusted to give successively the fundamental, and then no overtones above the first, fourth, ninth, and seventeenth. Notable changes of quality and loudness are observed depending upon the relative intensity of the various overtones for each instrument. When

the fundamental only is recorded the instruments are almost indistinguishable, but the slight difference which remains when allowance has been made for the intensity differences and for a certain difficulty of the horn player getting the correct note, suggests that the quality of a musical note depends also upon the rate of growth and decay, and it would be interesting to hear the effect of various amplitude changes imposed upon a tone which when sustained was pure and of single frequency.

The remaining records deal with the quality changes produced in much more complex sounds consisting of a short musical passage played by a number of instruments and with a passage spoken by the normal voice. The original sounds cover a normal range of frequencies, and the filters introduced pass only the frequency ranges 375-2500 or 750-1250, below 1250 or 2500 or above 375 or 1250 vibrations per second. The effects of an overloaded amplifier with and without a middle pass filter are illustrated and the characteristic high hissing sound appears well in the spoken passage. Filters are not used in two of the records which demonstrate the effects of reductions in the general intensity of the same complex sounds. The intensity level is lower by steps of 1, 3, 5, 10, 20, and 30 transmission units (or decibels). Incidentally, these two records enable the hearer to obtain an idea of the scale of this unit which is being generally adopted.

Apart from the general interest of the records, it would appear that, provided we regard a good gramophone as fairly common, then the three records illustrating Fletcher's work on perception of pitch form the first example of a research worker in acoustics presenting results originally obtained with complex and expensive apparatus in such a form that the actual phenomena involved can be experienced by others not so equipped. The records may then be regarded as the analogues of the spectrum or X-ray photographs presented in papers dealing with other branches of physics.

### Common Commercial Timbers of India and their Uses.

THE technical publications of research institutes have rarely much attraction for the layman, nor are they commonly read by members of trades to whom they would prove useful. With this truism in mind, Mr. H. Trotter, forest economist at the Forest Research Institute at Dehra Dun, has recently prepared a brochure entitled "The Common Commercial Timbers of India and their Uses" (Calcutta: Government of India Central Publication Branch, 1929), designed for the use of timber merchants and other users of Indian timbers.

This booklet is based, as the author admits, on one drawn up in 1912 by his predecessor, Mr. R. S. Pearson, entitled "A Commercial Guide to the Forest Products of India". Mr. Trotter's work shows the great advance in knowledge in these matters which has been made since 1912. In the preface the author states: "A great deal has been written of late years concerning the 'vast forest wealth' of India. The fact remains, however, that except for teak and a few parcels of other timbers from Burma, Madras, and the Andamans, there is practically no export of timber from the country. In the same way, the Indian markets concentrate on teak, sal, deodar and a few other well-known woods, while local craftsmen content themselves with the cheapest timber available, whether suitable for the purpose for which it is intended or not."

Two factors are bringing about a change in the conservative ideas which have so long persisted throughout India. The first is the prohibitive prices to which the more commonly used valuable timbers have risen; the second, the valuable work carried out at the Research Institute during the past eighteen years. As is obvious from his work, Mr. Trotter regards the forest wealth of India from the purely timber point of view. Writers with perhaps a wider experience when alluding to the "vast forest wealth" of the country have not been so limited. If some of the most valuable timbers of the country were eliminated from the account, the value of India's forest wealth, regarded from the point of view of the requirements of the greater bulk of its population, would still be enormous; and to this may be added an increasing number of minor products of the forest the potential value of which is at present not computable.

The author divides his work into several chapters, dealing with the storage of logs in log ponds (the method being described and illustrated); air-seasoning—a section which will well repay careful study—kiln-seasoning; preservation of timber by impregnation, and a chapter describing various common Indian woods. This latter chapter is of importance, since, from the experience gained at Dehra Dun, it has proved possible to modify some of the descriptions