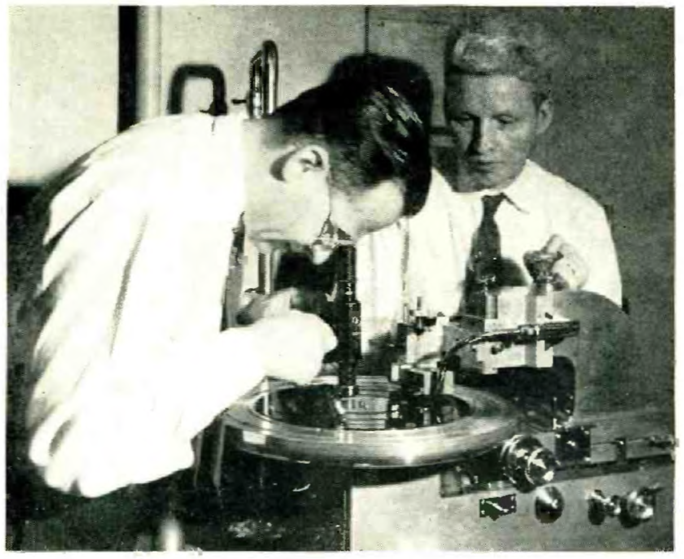

Peter C. Goldmark of CBS microscopically examines a new long-playing disk while Rene' Snepvangers looks on

William S. Bachman (standing) discusses one phase of the manufacturing process

Transcription Recordings for the Home

New 33-1/3 rpm recording system, cuts up to 300 grooves per inch, achieves low noise with Vinylite and pre-emphasis. Result: a six-record album on a single 12-inch pressing

A NEW APPROACH to satisfy the public demand for long-playing recordings has been jointly announced by Columbia Records Inc., a CBS subsidiary, and the Philco Corporation.

The new recording system, developed by Peter C. Goldmark, René Snepvangers, and William S. Bachman of Columbia, achieves a six-fold increase in recording time per disk by combining 33⅓ rpm transcription-standard turntable speed with an extremely fine pitch of approximately 260 grooves per inch. The decrease in turntable speed from the home standard of 78 rpm introduces a time factor of 2.35, while the larger number of grooves, compared with 85 to 100 per inch typical of conventional home records, provides an additional factor of about 2.6 times. The net result is that as much as 50 minutes of recording time can be accommodated on the two sides of a 12-inch disk, compared with 8 minutes on the older type. The records are known as LP, for long playing.

This is not the first time that 33⅓ rpm disks have been produced for the home market, but it is the first in which a system has been primarily engineered for this market. Earlier attempts failed because the groove pitch could not be made fine enough to secure a substantial increase in recording time, and the noise and distortion were high. Also, home-type turntables of earlier days tended to have excessive wow when operated at 33⅓ rpm. These problems were attacked by Peter Goldmark, well known for color-television developments, and his associates. The Philco Corporation undertook the design of a record reproducer which would meet the stiff requirements of low-speed service and still be marketable at a reasonable domestic consumer price.

Philco has also designed a two-speed turntable with a separate arm for the LP records.

Keys to the success of the new system are the use of Vinylite plastic for the pressings, the development of a new, efficient, light-weight reproducing arm and cartridge and mechanical refinements in the turntable driving mechanism. A pre-emphasis characteristic designed especially for the system, resembling closely the NAB standard transcription curve, was introduced to achieve high signal-to-noise performance. Also, many unconventional techniques have been adopted, including a degree of over-cutting which would not be acceptable in making conventional recordings.

Design Details

The grooves are about 0.003 inch in width, roughly one third the size of the standard record groove. Consequently, it is not possible to record at as high a level, by about 9 db as if the cut were held proportional to the groove width. Actually, the level recorded is about 4 db below the usual reference. The 4-db loss in level would not be acceptable if the record material were of the shelac type, but the low-noise properties of Vinylite together with the lightweight pickup permit a highly acceptable noise level to be achieved while maintaining a dynamic range in the order of 45 db. The consequent smaller excursion of the reproducing needle reduces the cartridge output by 4 db, but an efficient crystal has been developed which provides 0.7-volt output at reference level. Accordingly, no high-gain preamplifier is needed in the reproducing system.

The groove shape has an included angle of about 90 deg, and the tip radius is under 0.0002 inch. Accordingly, it is not possible to reproduce the new pressings with a standard 0.003-inch stylus. The cartridge perfected by Philco engineers, uses a balanced Rochelle-salt crystal and a groove pressure of only 6 grams (one-fifth ounce). It employs a semipermanent metal stylus lapped to a tip of 0.001 inch radius. The light pressure and small radius permits the stylus to follow the fine groove with tracking distortion lower than conventional practice. The stylus may be replaced without replacing the cartridge, if desired. To keep distortion at a low level, the diameter of the innermost groove has a minimum value of 5¾ inches, which is almost two inches greater than that of conventional commercial domestic 78-rpm pressings.

The practice of pre-emphasis has been standardized in the new records, using the characteristic shown in Fig. 1. Above 200 cps, the curve is identical with the standard NAB transcription characteristic, reaching 16 db pre-emphasis at 10,000 cps, relative to the 900-cps value. Below 200 cps the characteristic is higher than the NAB, being about 7 db above constant amplitude at 50 cps. The similarity of LP and NAB curves makes it possible to use the LP recordings on standard broadcasting transcription tables with no change in equalizing, although simple RC circuits suffice for equalizing in any event.

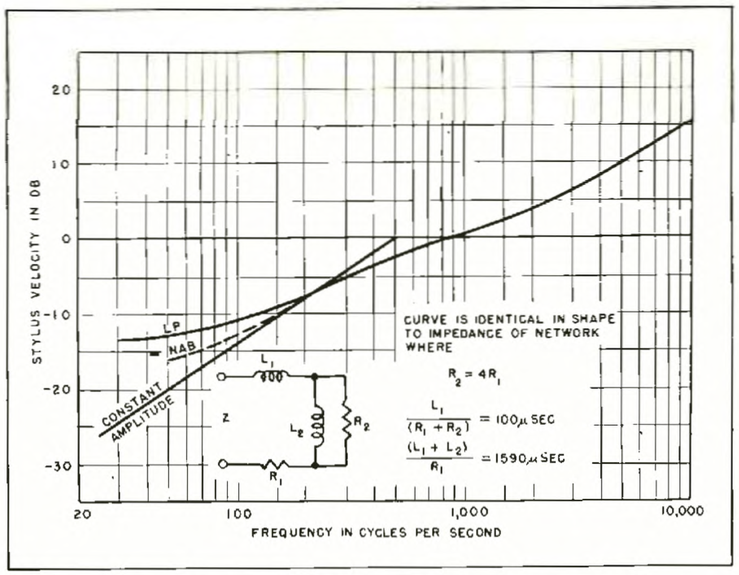

FIG. 1—Characteristics of new long-playing (LP) record, NAB transcription standard, and one having constant amplitude

Turntable Requirements

The wow problem assumes a serious aspect at 33⅓ rpm, since the speed ratio (1 in 2.35 relative to 78 rpm) requires that variations in turntable speed be reduced by the same amount. The turntables thus far used are of the rim-driven type. Care has been taken in centering the inner edge of the table, and in balancing the motor. Use of a high-grade rubber rim on the idler wheel is mandatory. Moreover, the edge of the rubber rim must be mechanically ground to assure near perfect circularity. In the Philco turntable, the idler wheel is withdrawn from the motor shaft when the table is not turning, to prevent developing a flat in the rubber. The design of the table is such that no appreciable wow was discernible.

Releases and Results

The early releases of the new records consist of rerecordings from existing masters in the Columbia files. Fortunately, in recent years these masters have been made on lacquer, rather than wax, so they may be dubbed without damage directly to the 33⅓ master. More than usual care is required, however, to exclude dust and other foreign matter at every stage in the production of master, mother, and pressings, and the difficulty of securing freedom from blemishes for a 25 minute period (one side) is considerably greater than for 4 minutes. Before release, pressings are checked for technical excellence by engineers on the Columbia staff, a revolutionary procedure in the recording business.

The results, as judged by critical listeners, both technical and nontechnical, are excellent. In frequency range, dynamic range and distortion, the LP records outdistance shellac pressings and, with the possible exception of noise surpass 78-rpm Vinylite pressings.—D.G.F.