TECH NEWS

by Rodger J. Ross

SOUND RECORDING ON MOTION PICTURE FILM

Recently there has been renewed interest in optical sound recording, brought about mainly by improvements in sound quality achieved with the Dolby noise reduction system. This system, developed in England by Dolby Laboratories Inc., at latest report, has been installed in over 20,000 audio recording, broadcast and television centres around the world, and is now gaining increasing favor in the motion picture industry.

Since the introduction of sound on film over 40 years ago, there have been significant improvements in picture quality in the theatres, but the audio portion has not kept pace. Although optical sound tracks are simple and economical to produce, theatre audiences accustomed to high fidelity audio performance in the home are likely to be dissatisfied with the quality of sound from film. One of the worst features of optical tracks is the relatively high background noise level.

Magnetic sound tracks on film prints can give better sound in the theatre, but on account of higher costs and the need to modify projection facilities, it seems almost certain that films will continue to be released with optical tracks. The possibility of substantial improvements in sound reproduction in the theatre through the use of noise reduction techniques now being proposed tips the balance still further in favor of optical tracks.

The first application of the Dolby noise reduction system in the motion picture field was to improve the quality of record albums being made from film sound tracks. The system works only in the quietest passages. Supplementary or "side chain" signal components are derived in four frequency bands, representing only a small percentage of the main signal. These components are then added to the main signal, just before the recorder, providing 10dB noise reduction from 30 Hz upwards, rising above 5 kHz to a maximum of 15dB at 15 kHz.

Low level signals at all frequencies are boosted by 10dB in the Dolby encoding unit prior to recording on film. In a theatre equipped with a Dolby playback unit, these components are decoded and attenuated by the same amount. Noise in a 35mm optical track can be reduced in this way to about 65dB below 100% modulation.

At the SMPTE technical conference in Toronto in November 1974 Ian Allen of Dolby Laboratories gave a demonstration of noise reduction and cinema equalization techniques. A paper by Mr. Allen on "Production of Wide Range Low Distortion Optical Soundtracks utilizing the Dolby Noise Reduction System" was published in the September 1975 issue of *SMPTE Journal.* This paper is devoted mainly to optical sound recording and reproducing methods, and contains much very useful information for anyone involved in this kind of work.

Mr. Allen gives an account in this paper of investigations made in motion picture laboratories in the UK to determine the causes of distortion effects and to improve the quality of optical tracks. Transfers were made from high quality magnetic recordings with Western Electric light valve and RCA galvanometer recorders. It was found that the recording equipment and the film have the capability to produce a very wide frequency range – a flat response out to 9 or 10 kHz. The electrical reproduction curve known as the Academy characteristic, together with the acoustical roll-off caused by the combination of inefficient high frequency loudspeaker units and screen attenuation, results in an optical tracks roll-off that starts as low as 1 or 2 kHz, increasing to -20dB or more at 8 kHz.

According to Mr. Allen, the aim of the Research Council of the Academy of Motion Picture Arts and Sciences, when the standard electrical characteristics for theatre sound systems were first published in 1938, was to achieve standardization of sound reproduction with release prints in circulation at the time – that is, the films were made to match the theatres, and the theatres were made to match the films.

In practice it is customary to apply pre-emphasis in recording optical tracks to compensate for the Academy roll-off. Pre-emphasis as normally applied changes the frequency spectrum of the sound in such a way as to increase distortion. Thus the Academy roll-off is indirectly responsible for a large part of the distortion in optical sound tracks.

It is suggested in this paper that the Academy characteristic should be modified in favor of a flat equalized record and playback characteristic, and the response should be raised at the high frequency end to take full advantage of the capabilities of optical tracks. However, it may not be possible to adopt a flat response at this time on account of the limitations of theatre loudspeakers. In the International Standards Organization a proposal is being considered for a curve flat to 2 kHz and then rolling off at 3dB per octave.

In the conclusion it is stated that traditional methods for producing sound tracks are often based on out-of-date technology, some of it from the earliest days of motion picture sound. Changes in these old standards are needed to raise the optical sound track to the quality standards of which it is inherently capable.

As of June 1975, about 400 Dolby noise reduction systems have been installed in theatres and eleven films have been released with Dolby encoded sound tracks, mixed at four different studios in the UK and USA.

At the recent SMPTE technical conference in Los Angeles, Mr. Allen gave another paper on noise reduction and equalization techniques with stereo variable-area sound tracks. This paper has not yet been published.

These are just two of the papers and one of the systems that are now at-

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