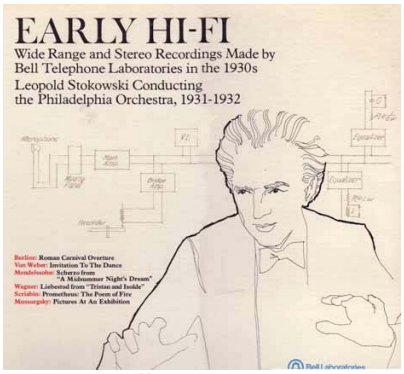
Bell Laboratories experimental stereo recordings--Philadelphia Orchestra; Leopold Stokowski, conductor (1931-1932)

Added to the National Registry: 2002
Essay by Larry Huffman (guest post)*

Stokowski, c. 1930

Label (1979)



Album cover (1979)

Origin of the Experimental Bell Laboratories Stereo Recordings

During the 1920s, as part of its research into improvements in audio transmission, Bell Laboratories, the research subsidiary of the American Telephone and Telegraph Company, developed technologies for electrical recordings of sound and music.[i] Previous audio recordings, since Thomas Edison's invention, were done with mechanical acoustic recording which did not require electricity. It was also of low acoustic fidelity to the original audio.[ii]

In April, 1931, Bell Laboratories began recording Leopold Stokowski, conductor of the Philadelphia Orchestra in the orchestra's home venue in the Academy of Music, Philadelphia. These recordings used new experimental equipment developed by Bell Labs and installed in the basement of the Academy of Music concert hall, with Stokowski's permission. Bell's objective was to record music at an audio fidelity not previously thought possible.

Prior to the introduction of the 33 1/3 RPM LP disc in 1948, records were recorded at the speed of 78 RPM (revolutions per minute). This new experimental equipment also recorded at 78 RPM, but did not use the conventional lateral (moving left-right) cutting heads used for contemporary 78 rpm disks. Arthur Keller and Alexander G. Russell, Bell Labs engineers, and other engineers, developed disk-cutting equipment which, instead, used a vertical cut ("hill and dale," or up and down motion) recording method.[iii]

The equipment used a new magnetic moving coil pickup fitted with a special sapphire stylus for cutting the wax master. This sapphire stylus cut a music groove in a soft wax surface, which was later coated with a very thin layer of copper.

Previously, the manufacturing process of recordings was to rub the wax surface with graphite to make it conductive so as to electroplate layers of nickel and copper, to make what was called a "master" from which metal "stampers" could be made to, then, stamp thousands of identical 78 RPM discs in shellac for sale to listeners. However, the rubbing of graphite onto the wax surface produced tiny scratches which made the disc noisy. The Bell Labs process was to produce a molecular layer of gold on the wax surface, allowing electroplating without creating a noisy surface.

These masters were pressed using cellulose acetate disks, rather than the typical noisy shellac material of the 78 RPM disks of that era.

This new Bell Labs equipment was able to record audio frequencies from about 50 Hertz to 10,000 Hertz. This gave much better fidelity to the original audio, not available with other conventional recordings of the era, which were limited to only about 65 Hertz to 4,500 Hertz.

Arthur Keller said that their recorded response in the Roman Carnival extended to 13,000 Hertz, the highest frequency response achieved up until that time by Bell Laboratories.[iv]

Additionally, the dynamic range--the audio range between quiet and loud music--was nearly doubled from conventional recordings, further adding to the fidelity to the original audio.

From December 1931 through May 1932, thousands of experimental recordings were made, first in monaural sound and, then, beginning in March 1932, recordings of the Philadelphia Orchestra were made in binaural or stereophonic sound.[v]

For stereophonic recordings, two cutting styli were used, each one in its own arm with the arms parallel to each other. One stylus recorded from the outer edge of the wax disk (as was normal), and, the other, beginning half-way into the disk. As a result, each stylus would cut half of the 78 RPM disk with a record groove containing a right or a left audio channel. Playback was the reverse process, using two playback styli.

Using this stereophonic equipment, the Bell Laboratories engineers recorded Stokowski and the Philadelphia Orchestra in a Russian program on March 12, 1932 in the Academy of Music. They recorded the "Poem of Fire" opus 60 by Alexander Scriabin and the Mussorgsky-Ravel "Pictures at an Exhibition" in this format. These recordings are the earliest surviving examples of stereophonic recording.[vi]

(Note: The brilliant young British scientist Alan Blumlein, working at EMI in Hayes, Middlesex, UK was another early pioneer of stereophonic recording. Some sources site his work, incorrectly, as being the first surviving stereophonic recordings. In 1933, using the stereophonic developments which Blumlein patented--patent issued in June 14, 1933--EMI cut a stereophonic disk with two channels in one groove, 90 degrees apart. Blumlein's first recording apparatus is described by A. J. Lodge of EMI Labs, in R.W. Burn's excellent "The Life and Times of A.D. Blumlein." This recording was a pioneering achievement. However, these recordings were done later than the Bell Laboratories recordings with the Philadelphia Orchestra.)

In 1979, Bell Laboratories asked Arthur Keller to come out of retirement to catalogue, and assist in transcribing some of the gold sputtered disks still in storage. Keller identified the Stokowski-Philadelphia recordings from among the 600 metal masters at the Bell Laboratories in Murray Hill, New Jersey.[vii] Of these, more than 100 were preserved by transcription, done by the remastering engineer Ward Marston.

The 1979-1980 restoration project of Ward Marston on these gold-sputtered metal masters was a massive and difficult task. These masters were cataloged and transcribed, including some of the stereo masters. Based on Ward Marston and Arthur Keller's work, Bell Telephone issued two commemorative 33 RPM LP albums with some of these transcriptions in 1979 and 1980, Bell Telephone BTL-7901 and BTL-8001. As far as I have been able to determine, all of the CDs and other media which circulate with any of this material come from these two Bell LP disks compiled by Arthur Keller and Ward Marston.

Hundreds of other of these 1931-1932 experimental high-fidelity recordings have survived. However, because of the many difficulties in transcribing these discs to digital files, and also due

to what seem to be an ambiguous copyright status of the original recordings, further issues to the public of these historic recording have not yet been possible.[viii]

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* The views expressed in this essay are those of the author and do not necessarily represent the views of the Library of Congress.

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[i] Fagen, M.D., ed. A History of Engineering and Science in the Bell System: The Early Years (1875-1925). New York: Bell Telephone Laboratories, 1975

[ii] Schoenherr, Steven Recording Technology History July 6, 2005 sandiego.edu/GEN/recording/notes

[iii] Burns, R. W. *The Life and Times of A D Blumlein* Institution of Engineering and Technology. Hertfordshire, UK. 2000. ISBN 0-8529677-3-X

[iv] Tebo, Julien. Arthur Keller: an Interview. March 13, 1973 IEEE History Center Interview #6

[v] Ibid.

[vi] Arthur Keller: BBC Interviews, broadcast on Radio 3, 1981

[vii] page 805 Journal of the Audio Engineering Society. Volume 31 no 10. October, 1983

[viii] page 5. Obert-Thorn, Mark excerpt of FRS Centenary Tape Features Reiner's Earliest Recordings. The Podium. Fritz Reiner Society. Spring/Summer 1988. Chicago, Illinois