

AN AFTERNOON WITH JOHN G. FRAYNE

Editor's Note: This is the third in a series of interviews with major figures in audio, which was conducted by the Los Angeles Section. This feature is an edited transcript of the interview with John G. Frayne on March 9, 1980. Peter Sutheim acted as moderator.



John G. Frayne

circles as the author of a textbook titled *Sound Recording*, which was coauthored with Halley Wolf. The book was one of the first to have a chapter devoted to magnetic recording from a professional point of view. An outgrowth of classes that John taught at UCLA, it was used as a textbook for many years.

Dr. Frayne, a fellow of the AES, received its Gold Medal Award for Outstanding Achievement in advancing the art of audio engineering in 1976 and the Emile Berliner Award. A past president of the SMPTE in 1955, he was awarded its Progress Medal in 1952 as well as its Journal Award.¹ Among substantive tangible contributions to the art, he pioneered the 45-45 stereo disk-cutting system developed by Westrex in the 1950s and gave the first public demonstration of it in 1958. Dr. Frayne was also very involved in film sound recording, particularly in the development of variable density recording as opposed to variable area. At some point I would like you to tell us something about this.

Frayne: I brought along a copy of the Frayne and Wolf book in case anyone asks me embarrassing questions, I will be able to look up the answers. I have been out of this busi-

¹Dr. Frayne's career was climaxed in 1984 shortly before his 90th birthday when he received an Oscar from the Academy of Motion Picture Arts and Sciences for the great engineering advances he brought to the art of motion picture sound recording.

Sutheim:

This afternoon's guest is a man who has been active in audio engineering before most of us were born. He is best known in some

ness for 20 years, and you people in the field now know so much more than I do.

Sutheim: One of the things I discover as I delve into the practice of audio is how much material you can find from 20, 30, 40, or 50 years ago. Recently, for example, audiophiles have gone crazy about the exact vertical and lateral tracking angle.

Frayne: It turns out that all the mathematics for that was done nearly 40 years ago. When this thing started, it was the Western Electric Engineering Department of AT&T. They had developed the electrical recording system for records and the electronic playback. It was done under a contract for the Victor Talking Machine Company, which later on was bought by RCA. The work was done at Bell Labs. It was published by Maxfield and Harrison in 1928 (reprinted in the *JAES*, May, 1978).

In 1926, the Bell System was eager to cash in on this research and tried to sell this synchronized picture technology to the motion picture industry. The big ones were Paramount, United Artists, MGM, Fox, and Universal. Nobody would buy it because they thought it was a crazy idea. Bell went to Warner Brothers, which was broke. At the time they operated in a run-down studio in Brooklyn and jumped at the chance, thinking they couldn't lose.

One of the Warner Brothers was smuggled into Bell Labs because we didn't want any of the motion picture people to know that we were trying to make a deal with Warner's. Western Electric made a deal with Warner's, which they lived to regret later on. It gave Warner's the exclusive right for 30 years to use this system and use their own name, which they dubbed Vitaphone. It was all Western Electric equipment.

There was also a provision that Warner Brothers was to sublease the system to other studios — which didn't present any problem at the time because the others turned it down.

Then Warner's made the first sound picture in 1926 called "Don Juan," which was based on the opera "Don Juan." They recorded only the music. It was done on a 16-inch, 33 $\frac{1}{3}$ rpm disk, which, by the way, somebody else invented 20 years later. The 16-inch disk was based on a playing time equal to a 1000-foot reel of film because in those days film was limited to 1000 feet.

At the same time that Bell was developing and promoting this synchronized system, they were also developing a sound film system. We chose the variable density system because it was considered the only truly photographic system. Variable density recording follows the same rules and laws of physics as motion picture taking. You make a negative and then a print. If you expose the negative properly and make the print properly, you get a linear relationship between what you see on the print and what went into the negative. I had to develop a light modulator that was satisfactory for that purpose. The process is well-known as the light valve, which is actually what's called a ribbon and pole galvanometer.

Warner's made the movie "The Jazz Singer," which by accident had a little bit of dialogue; it was mostly singing and music. But, unknown to Al Jolson, his talking was recorded, bootlegged, and put into the movie. At first, Jolson didn't want it. He thought his voice didn't sound right. "The Jazz Singer" came out in 1927, was a big success, and convinced the industry that the day of sound pictures had arrived. Then, the other studios, naturally wanted to get in on the deal right away because they found out they could make money on it. Warner Brothers turned everyone down flat. We licensed all the other studios. Meanwhile, this went through New York State laws into arbitration in the New York Court of Appeals. Of course, it didn't come to a conclusion until about ten years later. The results were sad for us, but good for Warner Brothers.

Sutheim: What were your first interests?

Frayne: One of the first things I got interested in when I joined ERPI (Electric Research Products Inc. was the subsidiary of Western Electric formed specifically to develop and market motion pictures and sound recording of all sorts) was to extend the volume range on film. With my colleague, Ray Scoville, we developed a noise reduction system. It was a system for the light valve of closing down the length of space between the ribbons when there was no signal, and opening up the ribbons as the signal increased. Thus, we reduced the noise on the film as the density of the print was increased. One of my first patents was on that.

Sutheim: You developed some special testing methods. Can you tell us about that?

Frayne: Scoville and I developed intermodulation testing. It was used on variable density because it showed all the harmonics, even and odd. When we studied intermodulation, we discovered that up to that time everyone had talked about harmonic distortion. There were many kinds of distortion, however, besides harmonic distortion. As a result of intermodulation, one gets all kinds of false frequencies, plus or minus. We received an Academy Award

for this work. Didn't get a gold medal, didn't get an Oscar — just a plaque.

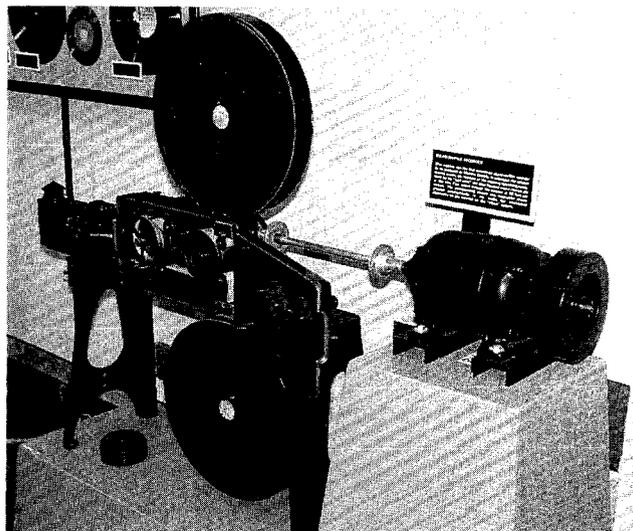
Sutheim: When they began recording the sound on the film, was it actually the same film that the entertainment was on?

Frayne: Oh, no, it was separate from it. They were combined later in double printing. It turned out to be the cause of a very important patent suit. Whenever a new art is discovered or a new form of something, the patent situation is very fluid. You may think you've got the entire thing sewed up, but some joker pops up from nowhere claiming he discovered it. They never come out of the woodwork until someone else develops it and puts money into it.

Bell Labs had a very fine patent department. In fact, it is so good that when any Bell Labs patent goes to Washington, it almost automatically passes. Most of this work was covered with patents. Unfortunately, they couldn't cover the variable density method of recording. That was patented in 1880 by Charles E. Fritts. The basic methods were all patented years before, but the patents expired. The Bell System could only patent the light valves. An outfit in Switzerland called the Tri-Ergon Company gathered up a bunch of patents developed in Germany. They had the basic patents on the use of a fly wheel to control the motion of film in a sound recorder; on double printing (printing a sound track alongside a picture); and on the use of a photoelectric cell to convert light to electric. They really had it sewed up. When they went to the Bell System, they offered to sell the entire thing — all three patents for \$40 000. I'm giving you a lot of information that was secret at the time.

We had a smart physicist whom I worked with, Donald MacKenzie. He was the person who actually developed the variable density system. He looked at these patents and said, "Oh, they're no good. Fly wheel was invented a hundred years ago; double printing is as old as the hills, photographers have been doing that for years, so that's no good." He recommended that we turn it down, which turned out to be a very expensive mistake for the Bell System. It cost them millions.

Then the American Tri-Ergon sued Altoona Publix Theatres Inc. of Pennsylvania, for using an RCA Photophone



Western Electric sound on film recorder.

Photos by Wade R. Bray

PS-1 projector soundhead. The suit went to the U. S. District Court for the Middle District in Scranton, Pennsylvania. For the first time, RCA cooperated with Western Electric because we were in the same boat. They developed all kinds of films and tests to win the suit but they lost out on both counts in the lower court. We took it to the Court of Appeals. However, it was affirmed in Philadelphia in the Court of Appeals, which was bad news for everybody. They were going to sue not only us but all the studios. Every theater would have to pay royalties. We made a lot of test films in Hollywood, with and without fly wheels, which I was in charge of for the court. The case then went to the Supreme Court, which first refused to hear it.

Then the Bell System, RCA and Western Electric got together and said, 'We'll ask the Supreme Court for a rehearing.' We hired a former solicitor general. The solicitor general of the United States is the person who argues all the government cases before the Supreme Court. He works under the attorney general, and is also the one who recommends appointees to the Supreme Court. He had recommended two or three of the judges sitting on the bench. We paid him a fee of \$100 000, which was a lot of money in those days.

The Supreme Court granted a hearing and reversed both the fly wheel and the double printing cases. The decision they wrote for these cases is now used in all universities where they teach patent law. As a result of these decisions, it has become much more difficult to get a broad patent.

Sutheim: Do you have any anecdotes about the record part of your career?

Frayne: Pierce and Hunt from Harvard made a very fine theoretical study of distortion in both lateral and Hill and Dale cut records. Unfortunately, they concluded that, from the distortion standpoint, lateral was better than vertical. It was very embarrassing. This happened around 1938.

There was an SMPTE meeting in Washington, D.C. I happened to be chairman when Pierce and Hunt gave their paper. I had seen the paper before, so I alerted the fellows at Bell Labs who got on the next train — there were no planes in those days — and came down to Washington. I wasn't sup-

posed to do this, but we had a little meeting the night before to decide how to handle the problem.

If you look at vertical, you have essentially a sphere rolling on a sine wave. However, the center of the sphere is not a sine wave, it's a hypoid with all kinds of distortion in it. This was shown in one of their slides. One of the Bell Lab scientists advised that while showing the slides, when this slide is projected, I should ask the projectionist if he would mind turning the slide over?

During the paper I did ask the projectionist to turn the slide over. But, our trick didn't stop the problem. At any rate, that was the beginning of the end of Hill and Dale and vertical cut.

Sutheim: Were you involved with the auditory perspective experiments?

Frayne: Actually no. But I do have a good anecdote to tell. If you look in a dictionary that was published before 1940, the word stereophonic will not be included. It didn't exist. You find stereoscope and stereoscopy, but you won't find stereophonic. The original idea behind what's now called stereophonic sound came from the audio perspective work by Harvey Fletcher at Bell Labs. The function of Bell Labs was to do the research, then turn over everything that could be commercialized to Western Electric.

When this auditory perspective system was turned over to ERPI they said, "You guys go ahead and develop this into a practical thing." The first thing Western Electric said was how can you say auditory perspective to anyone? No one knows what it means. They had a contest among the employees for names. And someone came up with the word "stereophonic."

Western Electric decided to copyright "stereophonic" because the word hadn't existed. The patent department, with all their brilliance, turned it down. Because there was something called a stereo-phone, which is a sterilized phone used in surgery, they thought it couldn't be copyrighted. We could have been collecting royalties for years.

Sutheim: Were you involved with microphones, at all?

Frayne: No, not in the development. We had enough trouble without bothering with microphones. We modified some out here in Hollywood. We did a lot of that. I want to tell you one microphone story, though. The dynamic microphone came out in 1931. Before that, it was all condenser for professional use at the time. The condenser had a peak about 5 or 6 dB at 3.5 kHz.

When we took our new 680 (first dynamic mic) to the studios to demonstrate, no one liked the result because that peak in the middle was not there. They were used to hearing it. We put it in electronically and called it "voice effort equalization."

Sutheim: We all thank Dr. Frayne for his time and for telling us a lot of "behind the scenes" history at Western Electric. We have a plaque for you from the Los Angeles Section. It states our appreciation for your coming here and sharing your experiences with us and for all the things you have done to contribute throughout the years to the audio industry.



First electrical recording apparatus by Western Electric.

Vitaphone recording lathe.