Recording History – *an overview*

In the Beginning 1890-1900

The story of the sound recording industry is mostly a story of musical entertainment on phonograph discs for the whole period from the invention of the phonograph in 1877 to about the 1950s, when new technologies emerged. The major players in the industry were Victor, Columbia and HMV (which originally stood for His Master's Voice) until the end of World War II, and are still important today. These three companies all got their start in the 1890s, when the phonograph was still young. Thomas Edison's 1877 invention of the phonograph was followed by many imitators, most notably the "graphophone," which became the basis of the Columbia company. Both inventions used a cylinder record which captured sound in a groove. Just as the graphophone of 1887 borrowed many ideas from Edison, so too did Edison's "improved phonograph" of 1888 borrow back from the graphophone. Soon both machines were for sale or lease to the public. The primary market was intended to be businessman, lawyers, court reporters, and others who currently used stenography to capture important thoughts or compose letters. Although the sound recorder as a business machine has its own history, it is the entertainment uses of sound recording that made the biggest impact.

Growth and Sales 1900-1925

Business phonographs (and graphophones) were selling very poorly in the early years and the phonograph industry was near bankruptcy. But in 1899, someone had the bright idea to built a coin-operated phonograph, record some songs on cylinders, and put the machines into the arcades, which were quite popular at the time. The public loved it. The various companies making phonographs quickly went into the cylinder business, and some of them redesigned their players so that they were cheaper and simpler, hoping that people would buy them for their homes. The idea of a truly inexpensive machine that could play back (but not record) music was the inspiration for an even more successful technology--the disc record or "gramophone." Edison himself had considered a disc phonograph, but it was Emile Berliner who really got the ball rolling. Part of the reason for a disc instead of a cylinder was that Berliner thought it would be easy to stamp out large numbers of copies of disc recordings. In 1893 he began selling his cheap gramophone player and seven-inch disc records made of hard rubber. Emile Berliner in 1896 hooked up with Eldridge Johnson, a machinist from Camden, New Jersey who designed an improved gramophone player for the Berliner company. In a short time, the two joined forces to create what would become the Victor Talking Machine Company. Victor in the early 1900s became one of the largest manufacturers of "talking machines" and records. In 1889, Berliner had arranged for the establishment of a branch of his company in London. Although officially known as the Gramophone Company, it was better known by its brand of records, called His Master's Voice, or HMV, and by Nipper the dog, which later became the mascot for Victor. Meanwhile, the cylinder phonograph business had been in such a shambles that the original owners of the various companies lost control of their businesses to shrewd businessmen. The Columbia company had started life leasing business phonographs in Washington, D.C., but was soon making home cylinder graphophones from a factory in Bridgeport, Connecticut. The company's leader, Edward Easton, was not sure whether cylinders or discs would ultimately succeed, so soon Columbia was manufacturing both. Soon, three companies (Edison, Victor, and Columbia) were the Big Three in the record and record player businesses in the United States, while HMV and the various subsidiaries set up by Edison and Columbia dominated the market in

Europe. They were selling about 3 million records a year by 1900 in the U.S. alone. The success of the record industry during the next two decades was phenomenal. Soon, the record industry was one of the most important in the world.

The Music….

1917 - The first "Jazz" record "Livery Stable Blues" was recorded by the all-white Original Dixieland Jass Band from New Orleans, according to The Origins of Big Band Music. Jazz recordings stimulated the recording of the blues, first popularized by vaudeville performer Ma Rainey who became the first successful blues singer in 1902 and later recorded 100 songs 1923-1928 for Paramount as the "Mother of the Blues," by black composer W. C. Handy in 1911, and by Mamie Smith who recorded the first vocal blues song, "Crazy Blues" in 1920, on the Okeh label.

1919 - Gennett Record Company in Indiana began to make lateral-cut records and was sued by Victor. Smaller labels such as Okeh, Vocalian, Compo joined Gennett in defending its claim that lateral-cut was in the public domain. Gennett won case 1921 before Judge Learned Hand and won appeal 1922 before Judge Augustus Hand, cousin of Learned. Gennett became one of the largest record producers in the nation, releasing some of the earliest jazz records of Jelly Roll Morton and opened the gates for smaller independent companies to record their own records.

1920 - David Sarnoff in January proposed in a 28-page memo the "Sales of Radio Music Box for Entertainment Purposes" and led RCA into cross-licensing patents with AT&T and Westinghouse and to leadership in the broadcasting and recording industries by the end of the decade.

1920 - KDKA in Pittsburg inaugurated commercial radio when it was the first radio station to receive its commercial call letters from the Department of Commerce Oct. 27; it began regular scheduled broadcasting Nov. 2 with the returns of the presidential election, and continued broadcasting every evening from 8:30-9:30 pm.

1921 - Public address amplifiers and speakers developed by AT&T since 1916 were used at the Armistice Day ceremonies at the Tomb of the Unknown Soldier in Arlington Cemetery.

1921 - majority record sales began decline from $106 million high due to the growth of live radio, but new kinds of minority music become popular.


Bessie Smith, from LC

1921 - The Coon-Sanders Novelty Orchestra in Kansas City recorded "Some Little Bird" for Columbia, began regular radio broadcasts Nov. 1922 on the clear channel station WDAF, and recorded 65 songs for Victor 1924-32, becoming one of the nation's most popular big bands of the Jazz Age.

1923 - Bessie Smith's first record "Down-Hearted Blues" was an important landmark on The Blue Highway, selling 750,000 copies for the Columbia label in one year, and making Smith the "Empress of the Blues." Her recording of Handy's classic "St. Louis Blues" with Louis Armstrong on cornet for Columbia in 1925 was one of the finest records of the era, and led her to star in the 1929 RCA Photophone two-reel sound film *St. Louis Blues* with an all African American cast.

1923 - New York's **WHN** broadcast of the influential big band led by Fletcher Henderson.

1923 - Fiddlin' John Carson's "Little Old Log Cabin in the Lane" became the first hit country record.

1924 - Chicago's **WLS** started the National Barn Dance radio show.

1925 - The Rice-Kellogg research paper was published, establishing the basic principle of the direct-radiator loudspeaker with a small coil-driven mass-controlled diaphragm in a baffle with a broad midfrequency range of uniform response. On Nov. 28, **WSM in Nashville** ("We Shield Millions" slogan of owner Edwin Craig's National Life and Accident Insurance Co.) began its Barn Dance radio show (hosted by George D. Hay who had previously hosted the WLS Barn Dance show) that in 1927 became the **Grand Ole Opry** broadcast from WSM's Studio B on the new NBC network. The Grand Ole Opry moved to the the Ryman Auditorium in 1943 and with the Acuff-Rose 1942 studio and WSM's 1947 Castle Studio would attract recording companies to Nashville's Music Row.

Radio, Electrical and the Depression 1925-1940

Unfortunately, the boom in talking machines was drawing to a close. Even before the general downturn in consumer spending in the 1930s, the recording industry was in decline. At first, the culprit seemed like excessive competition. Over 150 companies were making records or record players by about 1920, and they were all trying to undercut each other's prices. But the radio also acted as competition. Radio broadcasting began in some parts of the United States around 1922. During the 1920s, regular broadcasts began in many areas of the U.S. and Europe. Radio networks appeared, which linked together stations and promised to bring in massive advertising revenue. The companies running these networks spent lavish amounts of money to create special programming that was more spectacular than what was available on records. Despite the poor sound quality of the early radios, people were attracted to the programs and bought fewer records. The downturn was disastrous. The size of the industry in the U.S. alone declined by about one half in the early 1920s, then stabilized for the rest of the decade. Manufacturers introduced an improved form of record in the late 1920s called the "electrical recording," hoping to lure customers back. This used microphones and electronic amplifiers in the studio to make the records, but could be played back on the old horn talking machines. Some manufacturers also introduced combination radio-phonographs. While these new technologies helped a little, when the Great Depression came the record companies were too weak to survive on their own. The phonograph division of the Thomas A. Edison company was the first to go, folding in 1929. Victor was bought by the Radio Corporation of America, and Columbia was purchased, appropriately enough, by the Columbia Broadcasting System. Most of the other names in the industry simply disappeared. In the 1930s, records continued to be sold in relatively small numbers. Classical music enthusiasts continued to buy records, but they were not a huge market. The radio broadcasters bought a fair number of records. There were new opportunities, too. When the talking motion pictures arrived, for a few years they actually used discs before switching to a system that put the "soundtrack" right on the edge of the film. In fact, the motion picture industry was where the real action was in the sound recording industry in the 1930s. Sales of recording equipment to motion picture producers sponsored research in improved technologies. The first stereophonic recordings released to the public were part of a motion picture, Walt Disney's Fantasia. It was only in the late 1930s that the number of record discs sold began to climb back

toward the highs of the 1920s. This was partly due to the gradually improving economy, particularly in the United States. It was also due to the growing number of jukeboxes in use. Jukeboxes consumed large numbers of records because they were usually changed every week or so. But the industry was still in trouble.

The phonograph, graphophone and other players purely mechanical devices through the 1920s. However, in 1924, Columbia began experiments with a new technology developed by the Western Electric Company (the division of AT&T that made telephones and related equipment). Western Electric's recorder used electronic amplifiers to drive an electromagnetic cutting head, rather than relying on the acoustic horn. The result was a louder, clearer record. In the beginning, the record players still relied on acoustic playback with a horn, but as the home radio became popular, it became more common for people to purchase record players that had electric motors and electronic amplifiers. Some of them had a built-in loudspeaker, while others plugged into specially equipped radio sets and played through them. While some said the new "Orthophonic" records sounded harsh, they soon dominated the market.

"Transcription" recorders like the one here were a later variation of the basic electrical recording technology. In this type of recorder, electrical signals are delivered to the electromagnetic cutting head, which is carried in a lathe-like mechanism (the operator has his right hand on the lathe). Edison, who had experimented with a form of electrical recording from the beginning, created his own version of the technology as well. Shown here is a close up of the machine from the side. Visible in the center is the large, heavy platter, the cutting head with its horseshoe-shaped electromagnet armature (left) and a microscope for observing the groove.

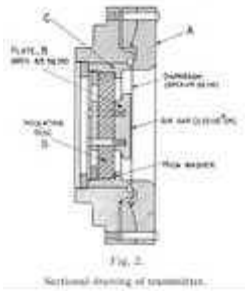
Electrical Era Timeline…

1915 - AT&T inaugurated the first transcontinental telephone service for San Francisco World's Fair, made possible by the new vacuum tube amplifier developed by Harold D. Arnold at what would become Bell Labs (see Evolution of Bell Labs for the changing names and corporate structure of the Labs). Arnold had been one of the first to recognize the significance of Lee de Forest's audion tube as a way to amplify telephone signals. After John Stone from the Boston Bell Labs arranged a demonstration of the de Forest tube Oct. 30, 1912, Arnold started his amplifier research project. Using a vacuum pump from Germany, he discovered that removing the air from the tube greatly increased the flow of electrons across the grid electrodes. He built the first amplifying vacuum tube Oct. 18, 1913, and began to install the tubes in telephone amplifiers for long line transmission. Arnold also began a long-term research program to improved the quality of telephone sound, "to get an accurate physical description and a measure of the mechanical

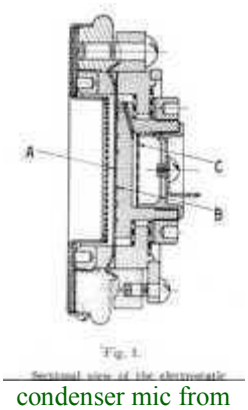
Arnold's 1914 tube, from Fagen 1975

operation of human ears in such terms that we may relate them directly to our electrical and acoustical instruments..." (Arnold quoted in Fagen 1975 p. 929). Arnold's program marked a new direction in the "Grand System" of Alexander Graham Bell that would lead to a revolution in sound recording.

1916 - Harvey Fletcher joined the Research Division of Western Electric Engineering Dept to work with Irving Crandall on hearing and speech, was director of acoustic research at Bell Labs 1927-49, built the Western Electric Model 2A hearing aid and a binaural headset in the 1920's, published the widely-read book ***Speech and Hearing*** in 1929 that analyzed the characteristics of sound. Fletcher would lead much of the research on binaural, or what later would be called "stereophonic" sound recording, at Bell Labs.


Physical Review 1917

1916 - E.C. Wente at Bell Labs developed the condenser microphone to translate soundwaves into electrical waves that could be transmitted by the vacuum tube amplifier. His patent 1,333,744 entitled "Telephone Transmitter" was filed December 20, 1916 and granted March 16, 1920. The device used two condenser plates, one of which was a very thin steel diaphragm .002-inch thick, spaced .001-inch from a large backplate. In his 1917 article, Wente explained "The general construction of the transmitter is shown in Fig. 2, from which the principal features are evident. The diaphragm is made of steel, 0.007 cm. in thickness, and is stretched nearly to its elastic limit. The condenser is formed by the plate B and the diaphragm. Since the diaphragm motion is greatest near the center, the voltage generated, which is proportional to C1/C0, will be greatest if the plate is small." This produced a flat response to 15,000 cycles in the lab. Wente continued to improve the microphone.



condenser mic from *Physical Review* 1922

In his 1922 article, he explained, "A sectional drawing of the transmitter is shown in Fig. 1. The transmitter differs from the instrument previously described in several essential respects. The diaphragm, A, is made of 0.002 inch (0.0051 cm.) steel and is stretched so that its natural frequency in free air is 7,000 cycles per second. Annular grooves are cut into the face of the back plate, B, to give the diaphragm the desired natural frequency and damping. The length of the air-gap is 0.001 inch (0.0025 cm.). To keep out moisture, the space surrounding the back-plate is sealed off completely from the outside air. A thin rubber diaphragm, C, is provided to keep the pressure on the two sides of the steel diaphragm substantially equal under all conditions of temperature and atmospheric pressure." Wente made more improvements in 1923: "By a change in the dimensions of the film of air and by the substitution of a duralumin for a steel diaphragm in 1923 a condenser microphone was produced which had a sensitivity 100 times as great as that of previous models. This microphone was sufficiently sensitive to permit the pickup of ordinary sounds at a distance without interference from noise voltages generated in the amplifier, whereas the use of the older models under such circumstances would have been impractical." In 1926 this improved model was sold as the Western Electric 394-W microphone for sound motion picture production.

1918 - Henry Egerton patented on Jan. 8 the first balanced-armature loudspeaker driver, based on the 1882 balanced armature telephone patent of Thomas Watson, and used in the Bell Labs No. 540AW speakers developed by N. H. Ricker Oct. 6, 1922.

1921 - The amplifier, microphone, loudspeaker innovations were combined to create the first public address systems. The largest public demonstration of such as system took place on Armistice Day for the national broadcast of the burial of the Unknown Soldier at Arlington Cemetery, heard over 80 loudspeakers linked by telephone lines in New York, San Francisco, and Arlington. By the next year, standardized p.a. systems were introduced.

1923 - Wente developed the light valve in patent 1,638,555 entitled "Translating Devices", filed May 1, 1923 and granted August 9, 1927. This ". . . . relates to translating devices and has for its object to vary the intensity of a beam of light in response to variations in an electric current." Wente placed a pair of stretched conductors forming a closed loop in a strong magnetic field. Alternating electric currents (representing the signal) passing through the conductors caused them to open and close the slit formed between them. A light beam directed through the slit could then be modulated to form a light record on a moving photographic film. This record could be a sound track or picture elements in a transmission system.

1925 - first electrically-recorded discs and Orthophonic phonographs go on sale, using Western Electric system developed at AT&T's Bell Labs over the previous 10 years, making it now possible to record whole orchestras and symphonies and even sound motion pictures. Henry C. Harrison at Bell Labs developed a matched-impedance recorder to improved the frequency range from the previous narrow 250-2,500 cycles range of acoustic recorders to a wider range of 50-6,000 cycles using the condenser mic, tube amp, balanced-armature speaker, and a rubber-line acoustic recorder with a long tapered horn. This system was licensed to the Victor Talking Machine Co. that used it in April to make the first electrical recording of the Philadelphia Orchestra conducted by Leopold Stokowski. The new system was sold in October by Victor as the Orthophonic phonograph capable of playing back acoustically-produced and electrically-produced records.

1926 - Wente developed the moving coil speaker, the Western Electric No. 555 Receiver (Horn driver) is described in patent 1,707,545 entitled "Acoustic Device", filed August 4, 1926 and granted April 2,

1929 . . . ." An object of the invention is to receive and transmit sound with high and uniform efficiency over a wide frequency range." Wente employed a moving coil/diaphragm mechanism moving in a strong magnetic field. It was designed to drive a theater horn and was rushed to the August 6 premier of *Don Juan*. The important feature was a conical plug in front of the diaphragm which shaped the expanding sound passages from an annular opening at the periphery to a circular aperture at the exit where an exponential horn was to be attached. This provided a fairly efficient transfer of sound from driver to horn with good fidelity at levels required in the theater. The development of the "555" receiver is shared with A. L. Thuras who filed on other aspects as described in patent 1,707,544 with simultaneous dates.

1928 - Wente and A. C. Thuras developed a moving coil, or "dynamic," microphone described in patent No. 1,766,473 entitled "Electrodynamic Device" filed May 5, 1928, and granted June 24, 1930. Thuras filed patents 1,847,702 and 1,954,966 and 1,964,606 in 1931 and 1932 for commercial models of this microphone.

1931 - in April, Leopold Stokowski invited Bell Labs to begin sound recording experiments with his Philadelphia Orchestra. After a series of disappointing radio broadcasts by NBC of his orchestra in 1930-31 that failed to achieve the high quality of reproduction Stokowski was seeking, he helped Bell Labs set up a test room at the Academy of Music in Philadelphia. Arthur C. Keller installed a vertical-cut recorder equipped with a new moving coil pickup with sapphire stylus that extended the dynamic range to 10,000 cycles. Surface noise was reduced by coating the wax master with gold film and a layer of electropated copper, and making the duplicate release copies pressed on ceullulose acetate rather than shellac. In December, the first electrical recordings were made and continued throughout the 1931-32 concert season. 125 of these test recordings have been preserved (a limited edition album of these masters was released in 1980 by Bell Labs).

1932 - in March, several test recordings were made at the Academy of Music using two microphones connected to two styli cutting two tracks on the same wax disk. On March 12 Stokowski recorded his first binaural disc, Scriabin's "Poem of Fire." This recording is the earliest example of stereophonic recording that has survived, although it was not called "stereo" at that time. Keller had apparently made similar dual recordings in New York in 1928 but were lost; Alan Blumlein made his "stereo" recording of Thomas Beecham and the London Philharmonic in January 1934.

1933 - first public stereo transmission over telephone lines of a concert conducted by Alexander Smallens in Philadelphia to an audience in Constitution Hall in Washington, D.C. on April 27, using a 3-channel system of microphones, amplifiers, loudspeakers and telephone lines. The test was a success , but FM would be used for high-fidelity music broadcasting, not telephone lines.

Then there was Hollywood…

For the home consumer, the phonograph (or, as it was often called outside the U.S., the gramophone), was the only widely owned sound recording or reproducing technology through the end of World War II. But in recording studios, particularly in the radio and movie industries, times were changing.

There were numerous attempts to record sound as a visible record rather than a groove, dating from the late 19th century. None was commercially successful until the early 1920s, when several firms introduced sound recording systems that recorded sound onto photographic film. They were all intended to be used with motion pictures, which had emerged as a major money maker in the 1910s. Thomas Edison, Western Electric, and others had developed phonograph-based systems for adding sound to motion pictures, but none worked well due in part to the difficulty of synchronizing the sound to the picture. With the optical systems, the sound was recorded directly onto the same film that held the images, so it was always in synch. Between about 1906 and 1927, numerous "sound-on-film" optical systems emerged, but they still had technical problems. In fact, many of the early talkies, including the famous film The Jazz Singer of 1927, used the sound-on-disc technology introduced by Western Electric. While perhaps the best of the disc systems, the Western Electric system began to be replaced by improved sound-on-film technologies as early as 1929. Sound-on-film became the standard way to record and reproduce sound in movies through the 1980s, and is still used some today.