

The education and tribulations of a precursory disc recording engineer

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This paper relates how fate, inquisitiveness, and coincidence combined to train the writer as a pioneer electrical sound recording engineer. Early efforts (1925...1928) to design and operate audio recording equipment will be mentioned. Portable recording equipment made it possible for the author to record in many remote locations for the first time. Recording adventures in the orient will be emphasized with slides (not included in the preprint).

INTRODUCTION

Nineteen twenty-five is a year to be remembered by all disc recording engineers since it was during that year electrical recordings were first sold to the public in increasing numbers. They sold like hotcakes and looked like them. Even Edison offered such a jumbo hotcake, also a vertical recorded L.P. record.

On Broadway "NO NO NANETTE" was a smash hit musical comedy. Vincent Youmans songs "TEA FOR TWO" and "I WANT TO BE HAPPY" were being played and sung throughout the nation on radio, in dance halls, and in homes, from phonograph records. And now this year (1971) "NO NO NANETTE" is back on Broadway and again it is an outstanding success. The star of the show is Ruby Keeler, who has not appeared on the Broadway stage since 1929. At that time she was the wife of Al Jolson, an entertainer who was responsible for the sale of millions of phonograph records. Quoting from LIFE magazine (Feb. 19) - 1971 is the year of nostalgia. I hope by this means that I can also make the year 1971 the year of nostalgia for many record buffs and audio engineers.

MY TRANSITION TO SOUND ENGINEERING

Coincidentally, in 1925 I graduated from the University of Illinois as a B.S. in E.E. Later that summer I went to the General Electric Company in Schenectady, New York, where I enrolled in R. E. Doherty's Advanced Engineering Course. Our studies were directed to train us as electrical power plant design engineers, but fate and chance interceded to make me, instead, a disc recording engineer. How this came to pass will soon be revealed.

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Upon arrival at G.E. I learned that I was one of a class of about 500 college graduates from all parts of the country. During my entrance interview I mentioned that I had operated the university radio station WILL and had attempted to build a Rice-Kellogg loudspeaker. Mysteriously, I was diverted from the power plant to the Radio Receiver Department in G.E.'s building no. 77. After acquiring the combination to the electric lock restricting the entrance to the radio receivers lab I was assigned to testing radio receivers, competing with RCA's "catacomb model" Radiolas.

At the lab I met several men who were pioneers in radio – Stien and Kinny (in charge of G.E.'s Radio Department), Carlson and Carpenter (who earlier were granted a patent on R.F. bias for magnetic recording), Barton and Becker (loudspeaker and radio receiver engineers). Another member of this group was Elmer Ingstrom, a radio transmitter engineer who later became the president of RCA.

Another member of our lab was Don Whalen, a classmate from the University of Illinois. Don clearly foresaw the promise of the electric phonograph. In a technical paper he presented in 1925, he described the "Panachord", a disc record with a pitch of 300 lines per inch. The reproducer was a light weight pick-up about the size of a postage stamp, mounted on a polished rotating shaft to reduce transverse friction. The Panachord played for 30 minutes per side. Don also gave the name "Panatrope" to our first electric phonograph. He transferred to RCA in Camden with many other G.E. engineers.

During World War II, when I visited RCA in Camden, a discreet inquiry about Mr. Whalen's whereabouts revealed that he had been confined to a mental institution. He had sent requests to his former associates to supply him with headphones, wire, galena and oatmeal boxes, to build a crystal detector radio receiver.

The prime mover of G.E.'s radio operations in 1925 was Mr. C. W. Stone, a member of the Board of Directors. Other members opposed his proposal that G.E. produce home radios and electric phonographs. In that year the company had just begun manufacturing electric refrigerators for home use. During that decade ten percent of the company's income was derived from the sale of radios and phonographs.

Being thus involved in the production of sound equipment, Mr. Stone became interested in Mr. Hoxie's development of equipment for recording sound on film, using a G. E. galvanometer. He called on Warner Brothers in Hollywood to propose that they produce sound motion pictures using Hoxie's equipment. Warner Brothers' response to this proposal came in a letter addressed personally to Mr. Stone. Later he framed the letter and hung it on his office wall. In brief, the letter stated that Warner Brothers was most pleased with his presentation and his appearance but were not interested at this time in the production of sound motion pictures. However, he appeared to be ideally suited for a role in a forthcoming motion picture. Would Mr. Stone be interested in signing an acting contract with Warner Brothers?

A DESCRIPTION OF G.E.'S PROTOTYPE DISC RECORDING EQUIPMENT

Mr. J. O. Prescott was a record entrepreneur with wide experience in the fields of recording and manufacturing phonograph records. In 1926 he visited the General Electric Co., seeking an engineer with knowledge of electrical disc recording. After an interview I was offered the position with a salary of \$75.00 a week. This to me was a real inducement since my current G.E. salary had recently been raised to \$27.50 per week, with no overtime provision. I accepted the offer and moved to New York City, where I started my recording career in the studio of Gennett Records, at 39th Street near Fifth Avenue.

J. O. Prescott told me that he had a contract with Gennett to introduce electrical records to the market. In compensation, he was to receive a fee of five cents per record. This contract seemed equitable since Gennett sales of popular records seldom exceeded 5,000 pressings per 10 inch record. These records sold for seventy-five cents each in record shops and cost between seven and ten cents to produce. Gennett also signed a contract to lease electrical recording equipment from G.E. on a royalty basis. This contract also granted Gennett the rights to the sale of all future phonograph equipment to be manufactured by the newly formed Radio Corporation of America.

According to the contract, G.E.'s recording equipment arrived at the Gennett Studio. It had been built in the General Engineering Lab, under the supervision of H. B. Marvin. It consisted of a "PALAPHOTOPHONE" (which I will attempt to describe later), an oil-damped, electro-dynamic recording cutter which could be mounted on the same "float", which held the equivalent acoustical unit, and an audio amplifier rated conservatively at 50 watts. This amplifier was contained in an aluminum cabinet about 15 inches high, 12 inches deep, and 36 inches long. The plate supply for this amplifier was a 500 volt Exide lead-acid battery. Filaments were supplied by a second heavy duty battery. The "palaphotophone" exciter lamp required 18 amperes: Charging these batteries required no additional power source, since the electricity supplied in New York City at that time came from the Edison three-wire 110-220 volt D.C. system.

The "palaphotophone" was indeed a unique transducer for converting sound into electrical energy. Its design was patterned after the G.E. oscilloscope and later the RCA galvanometer used for recording sound on film. It consisted of a corrugated duralumin cone less than ½ inch in diameter, attached to a tiny mirror in such a way that sound impinging on the cone caused the mirror to rotate. The light from the exciter lamp focused on the mirror through a multi-slotted mask.

Before this light entered the photo-electric cell (P.E.C.) it passed through a similarly slotted target, positioned so that normally only half the light entered the P.E.C. Sound striking the cone caused the mirror to rotate, thus increasing or decreasing the light entering the P.E.C., which resulted in an audio signal. Multiple slots increased the sensitivity of the device. Acoustically the "palaphotophone" resembled the mechanical unit it was designed to replace. A frequency calibration showed a peak of 12 D.B. in its mid-range (3,000 c.p.s.).

The sensitivity of a transducer is measured by its reciprocity, viz., sound entering a transducer produces an audio signal and vice-versa. The reciprocity of the "palaphotophone", I'm sure, approaches zero. Being aware of the vagaries of this device before leaving G.E. for New York City, I borrowed an engineering model of a condenser microphone and amplifier from Joe Chambers, a design engineer in G.E.'s radio broadcast department. We nicknamed this device "the magic lantern". It consisted of a tubular aluminum case which enclosed the mic and a two stage amplifier. On days when the humidity was low, the magic lantern proved to be a satisfactory microphone for sound recording.

However, tests of this recording equipment in the studio indicated the presence of too much bass. This reduced the volume of the sound recorded. Some records reproduced with a harsh buzzing sound, even on the best mechanical phonographs. Logically, it was explained by the sales department, that there were at least 15 million such phonographs used in homes throughout the United States alone. Who could enjoy listening to such raucous sounds being emitted from their favorite phonograph horn.

I believe it was Mr. Maxwell [actually, Maxfield (ed)] of Bell Labs who first proposed that electrical recordings be restricted to constant amplitude below 250 c.p.s. and constant velocity above that cross-over frequency. I found that by capacity coupling the output of the microphone pre-amplifier to the recording amplifier I could approximate this response.

THE MIAMI STORM

In February of 1927, while these tests were being conducted, Miami, Florida was devastated by a powerful hurricane which caused much property damage and loss of lives. Two days later Vernon Delhart and Carson Robinson came to the Gennett Studio with a song they had just written, titled "THE MIAMI STORM". We recorded the song as a duet with Delhart playing the guitar and Robinson interjecting an harmonica solo, The sale of this record was phenomenal for Gennett. Within a short time Mr. Prescott's fee of five cents per record exceeded the president's salary and his contract was terminated.

Another of our records which held promise of success was titled "TWO BLACK CROWS", featuring Moran and Mack, a pair of black face comedians from the vaudeville stage. However, the performers were asking an advance royalty of \$10,000.00 in lieu of a fixed recording fee. Most recording companies refused to pay what they considered an exorbitant amount. However, Mr. Prescott took a test pressing to Columbia and convinced them to release the record. Soon everyone was extolling the softness of "goofer feathers" and asking why the early bird should get the worm. Needless to say, Moran and Mack's royalties far exceeded the \$10,000.00 advanced to them by Columbia Records.

It became increasingly difficult for us to understand why our electrically recorded records had a much higher background noise than mechanically recorded records. After a recording session one afternoon we decided to enjoy a leisurely dinner in town. We then returned to the studio about 8:00 P.M. to check the electroplating tanks. The mystery was solved. In the tank where the electrical recorded waxes were being copper plated we found a bag of small iron nails suspended from a cord.

By now, unbelievable as it seemed to me, Gennett became convinced that there was no market for electrical records. The company canceled its lucrative contract with RCA and restored the mechanical recording equipment. In a short time the studio closed, the belated dire toll, no doubt, of "THE MIAMI STORM". G.E.'s recording equipment was moved to the Brunswick Recording Studios and I resumed my recording duties at that studio, which occupied the sixth and seventh stories of the building at 799 Seventh Avenue in New York City.

TRAVAIL OF A PRECURSORY RECORDER

Brunswick's New York studios comprised three recording rooms: A) for large musical groups; B) for vocal and smaller groups; and C) for special and experimental recordings. These studios are still in use at present by Columbia Records. Competition between studios and recording engineers was keen and very unorthodox in 1927. Microphones, recording cutters, etc., were always locked in a large safe after the recording session was completed. Equipment which had proven worthless remained on desks and benches to tempt burglars hired by competitors. Brunswick's studios were protected at night by an alarm system similar to Morse Signal Devices. Before any publicity pictures were taken in the studio, the performers positions were shuffled and inferior recording equipment substituted.

Formulas for recording waxes were closely guarded secrets. The wax was first warmed to a temperature of 85° to 90° so that it would cut smoothly without stylus "chatter". Batteries used to supply plate and filament current were mounted

on racks in the recording rooms. The presence of gases discharged from these batteries in such warm rooms subjected recording personnel to ailments unique to this profession.

Brunswick's recording machine was a marvel of engineering ingenuity. Power was supplied by gravity in the form of a 77 lb. cast iron cylinder which could be raised to a height of about four feet by means of a detachable hand crank. The aluminum turntable rotated at 78-80 R.P.M., for about five minutes, with one cranking. Recording wax was placed on the machine and hand centered as the turntable rotated. The turntable moved the wax under a fixed-positioned stylus, producing a spiral with a selected pitch of 84-112 lines per inch.

In 1927 Brunswick's ads stated that its records were recorded using a light ray recording technique. Since light is massless, Brunswick records were perfect. This ad was, no doubt, suggested by the "palaphotophone" microphone which had already proven impractical. Instead, G.E. supplied a new condenser microphone and amplifier. This microphone was about three inches in diameter, mounted in a floor stand, and connected to its pre-amplifier with a one inch dia. flexible low capacitance cable. The pre-amplifier at the base of the mic stand was housed in a wooden box about 12" x 18" x 18" high. The two type UV 201 tubes were shock mounted and the box lined with three inches of heavy felt to prevent vibration or sound from introducing extraneous noise into the recorded signal.

Several unsuccessful recording experiments should be noted at this point. One of our engineers decided that distortion was being caused by the recording amplifier's output transformer. To correct this flaw, he altered the circuit to impedance coupling. As he connected the recording cutter to the revised output circuit, the studio orchestra began to rehearse, thus subjecting the victim to an electrical shock of 500 volts D.C., plus the superimposed audio signal. A week later, when he recovered, the recording machine which had fallen to the floor with him had been repaired and the amplifier restored to its conventional circuit.

Another experimenter chose Saturday afternoon, when the studios were not in use, to make secret comparative tests of two recording systems. He chose the building janitor to supply the voice and conducted his tests in a locked recording room. As he paused to contemplate the results, he reached for a cigarette and, instead, ignited the gas which emanated from the overtaxed batteries. As flames appeared beneath the studio door, Mr. Thornley departed in haste for his home in the Bronx. The following Monday the frustrated experimenter was absent but Mr. Thornley returned to complete his weekend janitor work. His story was our only clue to what happened in Studio B last Saturday afternoon.

One day during the Winter of 1927, I received a request from Paramount Pictures to check some equipment at the Rivoli Theatre on Broadway. There I met Mr. Roy Pomeroy of Paramount's Special Effects Department. He explained that Brunswick's Studio in Los Angeles had recorded for Paramount the actual sounds of airplanes in flight, machine guns firing, automobiles driving by, etc. Although these records reproduced great in Hollywood, they now sounded less than satisfactory. The reproducing equipment consisted of four record turntables, four Brunswick Panatrope pickups with volume controls, and four RCA type 104 loudspeakers powered by four phonograph amplifiers. After repairing and replacing the defective equipment, the records again reproduced satisfactorily. The purpose of this equipment, I soon learned, was to reproduce the sounds of planes, autos, guns, etc., as they appeared on the screen. A clever operator (in this instance Roy Deshart of Paramount) could follow with sound the flight of a plane across the screen.

The equipment was later installed in the Criterion Theatre in Times Square and operated in conjunction with the motion picture "WINGS", which remained at the theatre for nearly a year. The newly formed Motion Picture Academy awarded Mr. Pomeroy an OSCAR for technical achievement in 1928. G.E.'s Mr. C. W. Stone later succeeded in having the sound for "WINGS" rerecorded to an optical sound track. I believe this was the first photophone sound recorded for theatre release. Incidentally, it took the audio industry nearly forty-five years to name this sound system. Now we call it QUADRISONIC.

Brunswick's Sales Department was endeavoring to increase business by offering records of artists from various parts of the United States, as well as from foreign countries. Obviously, such recording equipment must be portable. The chief obstacle was the 1,000 lbs. of battery used to supply power. A D.C. generator was substituted, driven by interchangeable motors to suit the local power available. The recording amplifier was also redesigned. It now utilized four type PJ train control tubes in the output stage, connected in push-pull parallel. This amplifier and control equipment was fitted into a sturdy trunk equipped with heavy handles on either end. The shipping bill of lading listed this unit at 350 lbs. gross. This weight was exceeded by another wooden case containing a wax shaving machine. Fortunately, this unit was only shipped to foreign locations.

Since I had pioneered the construction of this portable recording equipment, I was fortunate enough to be assigned to many recording expeditions in the United States and several foreign countries, as the sole recording engineer. Time may permit me to tell you only about one of four such trips to China; this one to Peking during the Winter of 1929-30.

WORLD WIDE MOBILE RECORDING

In January 1928 I was in Chicago recording in the studios of Brunswick Balke Collender Co. After a recording session I was called to the office of Mr. W. R. Jackson, vice president in charge of sales. Mr. Jackson informed me that the first G.E. portable recording equipment had finally been delivered to our New York studios. Could I operate this equipment alone? Not having seen the completed equipment I hesitated. Mr. Jackson poured two double shots of Canada's best smuggled bourbon and we continued our discussion. At the conclusion, I was sure that I could journey and record anywhere in the world, with Brunswick's backing.

Several days later I was on the train headed for Cincinnati, Ohio to record Ray Miller's Orchestra. We chose the radio studios of WSAI (The American Playing Card Co.) for this operation. When the equipment was unpacked, I failed to find the 77 lb. cast iron weight used to operate the recording machine. A parsimonious shipping clerk saw no reason for shipping cast iron across the country and left the weight on the loading platform in New York City. A machine shop at the studio provided an equivalent weight which would fit within the confines of the recording machine.

Despite such trivial tribulations, this first recording expedition was successful. It was soon followed by an expedition into "hillbilly" country, with a base studio in Ashland, Kentucky. Here the facilities for recording were minimal. A recording studio was set up in the loft of Carter's Music Shop using empty phonograph shipping cases for partitions. However, our artists were performing in familiar environs; they were at ease and their records were quite salable.

After recording about a month in Ashland, Jimmy O'Keefe (Brunswick's Musical Director) and I boarded a Southern Railroad train heading for Atlanta, Georgia. Here we found the facilities superior and the talent commercial. Our goal was to augment the Race Record catalogue. This category includes negro songs and music, usually "the blues".

When we finally returned to the New York City studios many changes awaited us. We were introduced to our new studio manager and staff with plans to expand Brunswick's recording activities. Foremost on the agenda for me was an expedition to Montreal, Canada, to record Jack Denny and his Orchestra. The foreign department planned to record "Canuck" artists – French-Canadians who speak and sing in a patois unique to their race.

The mobile recording equipment was shipped to Montreal, and I readied myself for the trip. Unfortunately, the equipment did not reach its destination. The shipment was blocked at the border by Canadian customs officials. Not even our suggestions concerning the cultural and commercial advantages Canadians were sure to accrue could reverse this edict. Consequently, the recording cargo was trans-shipped to Plattsburgh, New York where it was installed in the Bridal Suite of the NEW CUMBERLAND HOTEL. The date was February 1928. It snowed again that night. Above the snow I could see nearby Lake Champlain from my second story hotel room.

The start of recording in Plattsburgh was postponed several days, due to the city's power supply. Electrical power for that city was derived from Niagara Falls hydro-electric 25 c.p.s. generators. An arrangement of V-belts and pulleys on the motor generator restored the recording voltage to normal.

In Montreal our talent scout arrived at a unique plan to offset the frustration of being unable to record in that city. As he took the artists to the train enroute to Plattsburgh, he slipped a pint of scotch or bourbon into their hip pockets. As they arrived at the studio I removed the bottles and placed them in a felt-lined trunk used for shipping recording wax and expressed the trunk to our New York studios. Several of our artists arrived at the studio exuberant about Brunswick's hospitality. Their recording session was rescheduled for the following day. They were inebriated.

After the frigid location in Plattsburgh, my next destination was Havana, Cuba, where the temperature reaches 120° Fahrenheit at mid-day in May. A cooler location was chosen at nearby Vedado Beach. Here Rhumba and Congo Sextetos were recorded to enlarge another category of Brunswick's Record Catalogue.

After Havana my mobile unit was loaded into the forward hold of a "Flota Blanca" banana boat and shipped to Vera Cruz, Mexico, via Yucatan. The frustrations of becoming an operational studio in Mexico City could encompass several chapters. Suffice to say that I found the Mexican musicians most talented and artistic. Were it not for the fact that almost every work day was followed by a holiday, my stay in Mexico would not have been nearly as delightful nor extended.

Returning to New York in July, I had just time enough to procure a United States passport with a Chinese visa, and a steamer trunk for my wardrobe. Stopping off at our main office in Chicago I received a black briefcase containing twenty-two letters of introduction and a letter of credit on National City Bank for \$10,000.00. I was also presented with a new Bell & Howell 16 mm motion picture camera so that I could make a photographic record of this round-the-world trip. In August 1928 I embarked from Los Angeles Harbor, via San Francisco, on board the S.S. President Lincoln with tons of recording equipment and fifty trunks of recording wax; destination Hong Kong.