THE HISTORY OF RECORDING

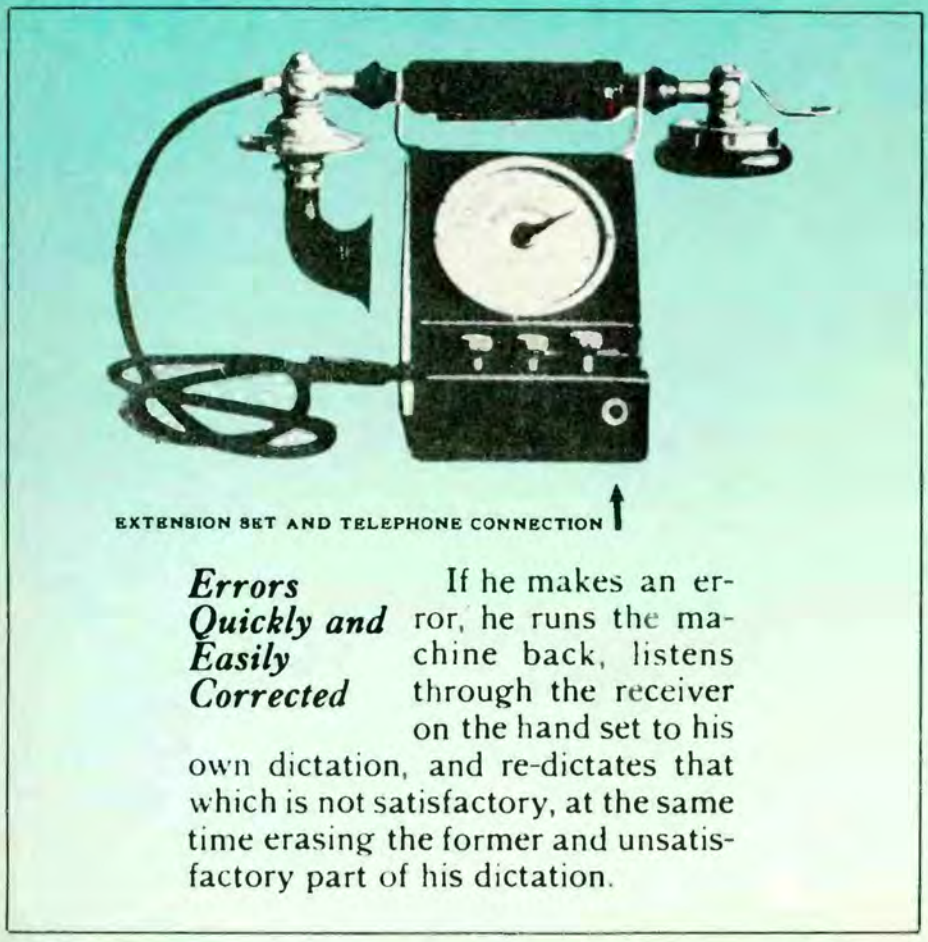
By Robert Angus

PART 2: The House that Rood Built (or The Vision of Charles Dexter Rood)

If Charles Dexter Rood had retired at the age of 65, he might well have gone down in the books which tell of the great 19th century New England merchant princes. Born on a farm in Ludlow, Mass. in 1840, his story might have served as the prototype for a Horatio Alger novel. But instead of taking it easy after an active business career, Charles Dexter Rood's path crossed that of the telegraphone, a wire recorder which serves as the ancestor of all of today's recorders.

When Rood (in central Massachusetts where the family thrives today, the name rhymes with "good") was born, Ludlow was a small farming community some five miles east of Springfield. Today it's an industrial and residential suburb. Rood received his education at Williston Seminary, then set out to find fame and fortune in New York. His first job was with a firm of jewelry importers as a salesman on the road, and it paid $500 a year. Shortly after he started work, Rood was offered the opportunity to go into the oil business in western Pennsylvania. Oil at the time wasn't the big business it was later to become with the invention of the automobile. It served as a patent medicine, but Rood saw a future for it as a replacement for whale oil in home lamps.

However, a career in the oil business was not to be his. When he told his employers that he wanted to quit, they upped his salary to $2500 a year —an unheard-of sum for a travelling salesman in the 1870's. Soon, he became a partner in the firm. Then in 1876, he was presented with his first opportunity to make real money. The New York Watch Company's plant had burned, leaving a pile of rusted machinery and an unemployed labor force. Rood sold his interest in his jewelry importing firm and used the capital to buy New York Watch. He packed up the company's few assets and shipped them to Canton, Ohio, where he founded the Dalber-Hampden Watch Company. The new company got off to a rocky start, and Rood occasionally had to go prospecting for outside capital. At one time, the company's directors considered borrowing to meet a dividend payment. Rood told them that if they did, they'd have his resignation in the morning. Eventually, however, the firm began to show a profit, and the company's president and general manager began investing his earnings in real estate—first in downtown Canton, later in timberlands in Michigan. By the time he sold the company in 1890, Rood had made it one of the most profitable of American watchmakers.



One of the early ads created for the fated telegraphone.

The Watch Man

Late that same year, another opportunity came Rood's way. Selling out his interest in Dalber-Hampden, he invested in the Aurora Watch Company of Aurora, Ill. The company had an unsavory reputation—not only with its dealers, who complained of shoddy merchandise, but with employ-

ees. In those pre-union days, Aurora had occasionally paid off its employees in watches and parts when cash ran short. The company's practice was to compute the salary equivalents in list prices for the watches and parts. The employees, if they wanted cash, had to go out and sell the merchandise themselves, usually at wholesale, or about 50 per cent of the price they had been charged. The trouble with this system was that, with rare exceptions, jewelers received their merchandise on consignment from the manufacturers. Since they didn't have to pay for anything they didn't actually sell, they weren't very good markets for watches or parts being sold by employees. In short, the employees had all the cards stacked against them.

Rood announced that the practice would cease. He told the directors that he would resign the day Aurora failed to meet its payroll in cash.

Two years after his purchase of Aurora, Rood had the opportunity to invest in the Lancaster Watch Company of Lancaster, Pa. Lancaster's business, like Aurora's, had been poor —but the plant was in better condition and the labor supply more plentiful than in Illinois. Rood promptly merged the two firms to form Hamilton Watch Company, and packed up parts, machinery and personnel from Illinois for the trip to a new home in Lancaster.

The move, at the time, was considered one of the biggest of its kind. Never before had a company of Aurora's size simply packed up its plant and moved a thousand miles. Rood moved with the plant to Lancaster.

During his 16 years as president, Rood made the name Hamilton synonymous with the running of railroads on time. He persuaded every major railroad in the country to equip its trainmen and conductors with Hamilton watches, and to use Hamilton as their official timepiece. Then he advertised the fact, and the public bought.

Rood reached his 68th birthday on January 1, 1908—a time when most men would have considered retiring. His progression through the jewelry business and watch manufacturing had made him a millionaire. And there were his real estate speculations. Lands he had bought in Canton when they had been cow pastures were now in the downtown business area. Accordingly, Rood sold his interest in Hamilton and friends thought he was about to retire to Springfield.

Rood and the Telegraphone

Then he heard about a marvelous new business machine which could do everything Edison's dictaphone could do for a fraction of the price. Whether Rood was introduced to the struggling finances of American Telegraphone Company by its president, Judge John Lindley of New York, or whether he learned about it on his own, Rood saw an opportunity to match his missed chance for a fortune in oil.

In May, the directors of American Telegraphone met in Washington, D.C. They had a problem. Although the company had exclusive rights to the patents of Danish inventor Valdemar Poulsen for a low-cost magnetic recording device and had raised some $5 million through the sale of stock, it had failed to make a single telegraphone. True, there was a factory in Wheeling, W. Va., and some employees. But President Lindley told his associates that without some new capital soon, they would have no company.

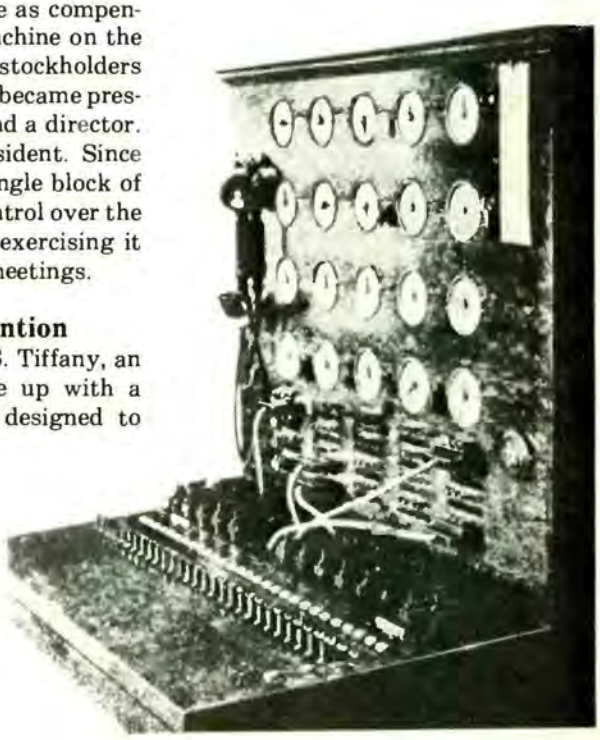
While the board discussed this news, Lindley excused himself to make a long distance telephone call. The man he spoke to was Charles Dexter Rood, who told him that he would give the company all the capital it needed. All the directors need do was to issue 94,000 shares of new stock to Rood at a price of $2 per share, yielding $188,000 in new capital. Rood was to receive no salary. Instead, he was to get the difference between $2 and the par value of $10 per share as compensation for putting the machine on the market. At the annual stockholders meeting on July 30, Rood became president, general manager and a director. Lindley became vice president. Since Rood's was the largest single block of stock, he had effective control over the company—and he began exercising it by refusing to call board meetings.

The Tiffany Invention

At the end of 1908, G.S. Tiffany, an American inventor, came up with a modification which was designed to improve the operation and reliability of the telegraphone. As one observer described it, "The old telegraphone . . . arranged the spools of wire to take the record vertically and by reason of the vertical arrangement these spools were very free in their motion. They had a drag to keep it from running wild. But we all know the momentum of any spool that is arranged vertically . . . . It was not what we call foolproof . . . , as the momentum of these spools would enable the wire to get slack once in a while; when this took place, the strand ran off the periphery of the spool, and you had a tangled wire to untangle.

"This Tiffany method . . . arranges the spools horizontally with carriers underneath each spool with a rod going through each carrier with spring fingers underneath a plate that travels on each carrier, and that carrier, with the spring finger, is alternately lifted and brought back to the condition of normal rest.

"These two carriers have a belt going from the motor under one, around the other, enabling these two carriers to travel always in opposite directions. The result is that when the machine is going forward, the carrier to your right is resting directly upon the right hand spool, cork inserts in carrier allowing for such slippage as will prevent any jerk, and insure evenness of operation. The other one, however, is



THIS TYPE OF SWITCHBOARD IS BEST ADAPTED FOR LARGE CONCERNS

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elevated by a rod, and instead of resting on that carrier, the spring fingers hold two spools taut the other way, so when going backward, forward or at rest, the wire is always taut, a very ingenious improvement." An improvement, incidentally, built into the early home wire and tape recorders in the 1940's.

Poulsen was highly pleased with the Tiffany invention, and urged the company to acquire the rights to it. Rood seemed little interested, despite the prodding of members of the board of directors. His indifference continued the following year, when the U.S. Commissioner of Patents asked for an exhibit of the Telegraphone for the Alaska-Yukon-Pacific Exposition to be held in Seattle that year. Congress had appropriated money to finance exhibits of scientific marvels like the telegraphone, and some stockholders felt that the prestige of being invited to take part would be very good for business. Rood acknowledged the request, and agreed to furnish a model. But as the time for the show drew near and no model was forthcoming, company attorney John B. Larner demanded an explanation. Rood told him that the company was experimenting with new models.

Larner responded with a sharply worded letter: "I do not believe I can express my views any more strongly than I have stated them, and if I am to remain in the company, I want to see the by-laws lived up to in every sense." There was no direct answer; but directors suddenly found it difficult to find out what was going on at the factory. In a 1909 letter to the factory manager in Wheeling, Rood wrote, "Keep things to yourself because, as I know, information is like water. Spilled on the ground, it can never be gathered up again, and have your men keep all these things to themselves." Specifically, it was charged later, Rood didn't want the directors to learn about inactivity at the factory.

During his first three years as president, Rood managed to produce several machines in Wheeling. One of them was demonstrated for William J. Burns, founder and president of the detective agency which bears his name. Another appeared at the opening of the John Wanamaker department store in Philadelphia, to record the words of President William Howard Taft, the first on-location recording of a speech by a U.S. president.

Reliability The principles used in TELEGRAPHONE construction are so simple that its reliability is at once assured. Records are made and reproduced by a new adaptation of electro-magnetism, and the method of making and reproducing is telephonic, and has all the reliability, all the ease of operation, and all the naturalness of tone production of the modern and most highly developed telephone.



DICTATING TO A TELEGRAPHONE LOCATED ON ANOTHER FLOOR

Early in 1911, over the strong objections of Larner and the other directors, Rood moved the plant from Wheeling to Springfield, Mass. where he was building a mansion in which to enjoy his later years. Manufacturing was to be done in a loft at the corner of Dwight Street and Harrison Avenue downtown, with a business office just around the corner at 468 Main Street. On a bluff about a mile away sat the Rood homestead—in such a position that the old man could overlook both the city and his facilities.

Secrecy and Procrastination

Rood's critics promptly labelled the new plant "little better than a barn, where nothing could be manufactured efficiently." They wondered out loud why he had abandoned the facilities in Wheeling, which they described as excellent. And Larner and the other directors did something—they walked out in a body, charging Rood with procrastination in putting a model on the market, bad judgment in dismantling the Wheeling factory, and excessive secrecy in keeping the directors from finding out what was going on. Rood's secrecy had gone one step further. By invoking the patent rights, he had managed to prevent any engineering textbooks or technical manuals from publishing technical descriptions of the telegraphone, or explanations of the magnetic recording principle which made it possible. As a result, the American scientific community which had responded so favorably to Poulsen's 1900 Paris demonstration, was unable to get any information about magnetic recording after 1908.

Unaware of the scientific information blackout, a stockholder named A.M. McCrillis of Providence, R.I. called on Rood to find out what was being done about manufacturing and sales. McCrillis, a salesman, could see a big potential among businessmen for a low-cost dictating machine whose wire could be used over and over again (you could re-use dictaphone cylinders several times, too—but you had to pare the excess wax off each time with a penknife). McCrillis wanted the exclusive sales rights to the machine. He later charged that when Rood saw that he wasn't about to be put off with further talk about "experimentation," the president demanded a personal consideration for granting him the contract.

On the strength of the agreement, McCrillis set up sales offices in five cities—Washington, Boston, Chicago, Philadelphia and New York, with a home office in Springfield. He wasted no time in calling in a reporter for the Springfield *Republican* and bedazzling him with tales of the telegraphone, its achievements and its potential.

McCrillis camped in the vicinity of the factory until he got some machines. Then Rood told him it was impossible to produce more because he needed a turning lathe. McCrillis, a quick-tempered Irishman, bought the lathe himself, and delivered it to Rood. His reward was 50 machines. He sold 20 of these to E.I. DuPont, which used them as an office dictating system until 1917. During the rest of 1911, probably the high-water mark in terms of income and production, American Telegraphone produced another 150

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machines or so. McCrillis and his associate H.P. O'Reilly maintained an office at 40 Harrison Avenue, diagonally across the street from the American Telegraphone plant. They prepared and distributed a profusely illustrated booklet extolling the virtues of the telegraphone in business, showing the installation at the DuPont plant in Washington, Del. Price for a complete system, according to the booklet, was $240—including foot control, extension set, phone jack and a connection plug for use with a telephone or other equipment.

One of the 1911 machines fell into the hands of Lee De Forest, the father of radio, then vice president of the Radio Telephone Company. De Forest realized that Poulsen's original idea of recording telegraph messages and transmitting them at high speed had merit, but felt that the telegraphone needed an amplifier to become commercially appealing. Accordingly in 1912, he demonstrated the telegraphone in San Francisco with an amplifier of his own construction. Rood was unimpressed, but did agree to lend him another telegraphone for experiments the following year. De Forest took his machine to the old 14th Street studios of Biograph Pictures in New York, where he experimented in synchronizing wire-recorded sound with motion pictures. Rood failed to pursue this idea, and De Forest went on to develop the radio telephone instead.

When O'Reilly and McCrillis finally decided they weren't going to get the machines they wanted, they began canvassing minority stockholders for funds to wage a battle for control. They asked shareholders to contribute if they could, but guaranteed to protect the rights of all. After a number of court rebuffs, and after the Poulsen patent expired, O'Reilly founded the Record-o-Phone Company of Washington, D.C. to make telegraphones—and sought financing from the original stockholders in the parent company. In 1926, the attorney general of the State of New York was to enjoin him from further sale of stock in that state on the grounds that Record-o-Phone hadn't actually made anything. O'Reilly died the following year.

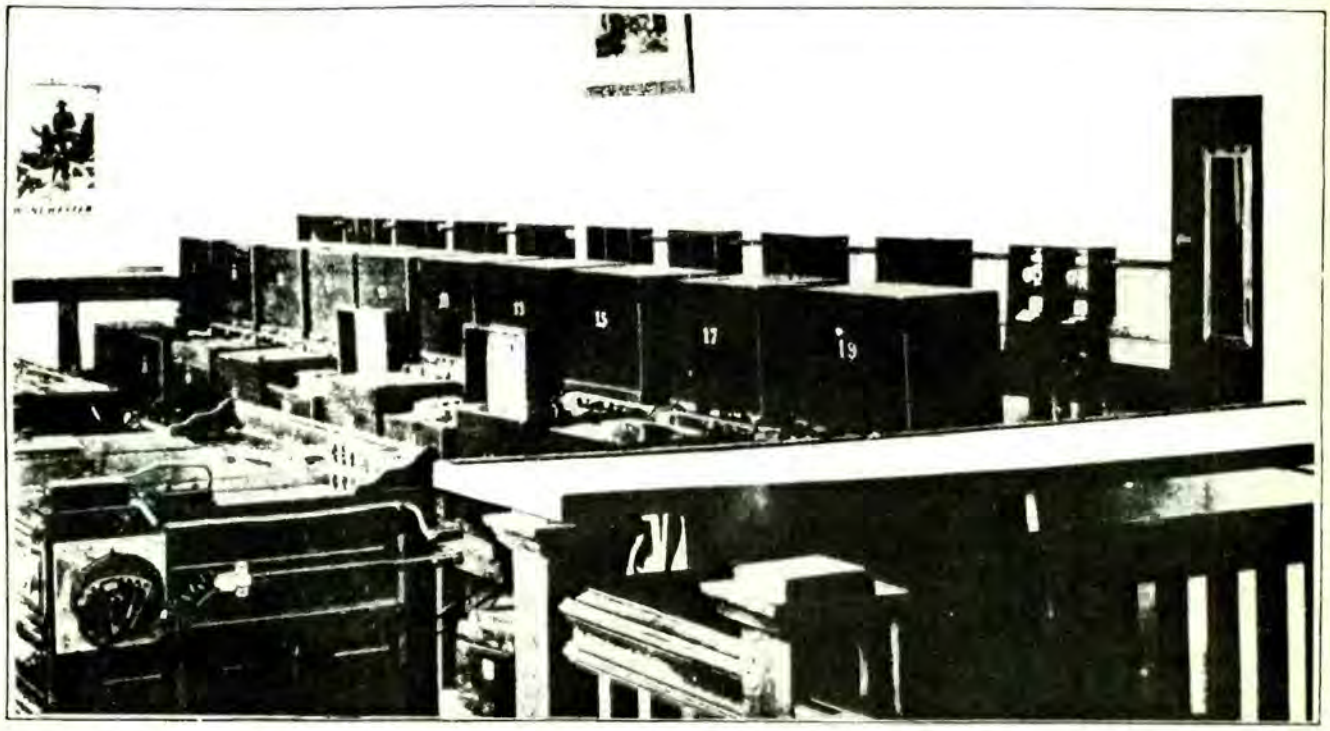
Gold Medal Winner

But we're getting ahead of our story. Toward the end of 1914, Rood got a letter from a stockholder named Frank A. Brittain, telling him that the Panama Pacific Exposition was scheduled to take place in San Francisco early the following year. Wouldn't it be good publicity to have the telegraphone on display, he wondered. Rood didn't answer. So O'Reilly pursued the subject. Not only would a public display of the telegraphone generate needed publicity, he argued, but it would help McCrillis sell machines.

Rood didn't answer at first. When O'Reilly pursued the subject, Rood told him that he didn't consider the benefits worth the cost of shipping a machine to San Francisco. Besides, he said, he didn't have one to ship.

When the fair opened, there was a telegraphone on display. O'Reilly had dug one up somewhere and paid the display and shipping costs himself. The results appeared to pay off. The machine promptly won a silver medal, which normally would have assured it automatic coverage by every major scientific publication. This wasn't good enough for O'Reilly, who invited the jury back for another look.

Following the second visit and demonstration, O.H. Fernbach, secretary to the superior jury, wrote O'Reilly, "This is to notify you that after due consideration of your protest, the superior jury has raised the award made on your telegraphone from silver medal to gold medal."



THIS INSTALLATION OF TWENTY MACHINES ACCOMMODATES THIRTY-SIX DICTATORS AND REQUIRES BUT TEN TYPISTS SAVING ITS OWNERS $100.00 PER WEEK

O'Reilly was in a jubilant mood. The top award could be promoted in company advertising, and there would be a rush of articles on this technical innovation followed by a rush of orders. Unfortunately, it was not to be. Rood had already notified any publisher likely to describe the machine in detail that he would consider such an article an infringement of the Poulsen patents. It was argued in retrospect that on the one hand, this was sound business practice to prevent other manufacturers from seeking a way around the patents; on the other, it prevented people from learning that there was such a thing as a telegraphone. Nevertheless, orders began streaming in on the strength of the award. Rood, by now 75, was to ignore virtually all of them. Just prior to U.S. entry into World War I, and unbeknownst to O'Reilly, McCrillis and the stockholders, Rood sold some telegraphones to the German government. By the time the war ended, the Poulsen patents had expired.

On Saturday, March 20, 1920, a trial began in U.S. District Court in Washington for control of American Telegraphone. Representing O'Reilly and his associates was George E. Sullivan, a prominent Washington lawyer. Rood was the defendant. By this time, American Telegraphone's chief assets were the Springfield factory and a supplementary patent obtained in 1914 on the Tiffany improvement. Sullivan argued that in the 12 years since he had assumed control of the company, Rood had failed to produce more than a handful of recorders that actually worked. Worse, he had turned down virtually every effort to publicize, advertise or promote the recorder. At the same time, the stockholders alleged, Rood had manipulated the stock to his own advantage, something relatively easy to do in those palmy days before the Securities & Exchange Commission. Sullivan said that Rood actually had gone so far as to deny directors any information about manufacturing and forbade the superintendent of the Springfield works to tell them anything.

Mr. Justice Stafford appointed a receiver to try to straighten out Telegraphone's tangled financial affairs. But the receiver had no funds to work with; and with the last significant telegraphone patents about to expire, there seemed little likelihood of raising additional capital by issuing new stock or bonds. The stockholders gained a partial victory, but Rood and his controlling stock remained in power.

Very shortly, Sullivan was later to testify, Rood and the receiver worked out an arrangement in which the receiver returned "incriminating documents" to Rood. Shortly thereafter, Justice Stafford turned the case over to the court's auditor, who, one stockholder reported, "trifled with it for four years, granting occasional hearings, just enough to keep the judge from intervening."

The auditor, Herbert L. Davis, was surprised in his office one morning when Sullivan swooped down with a court order to seize certain papers. In Davis' wastebasket, Sullivan found torn-up correspondence, including a letter of introduction to Walter Gifford, then president of American Telephone & Telegraph Co. Sullivan implied that it asked Gifford for a personal favor. Davis replied that the letter was written not in his own behalf, but for his brother. What made it improper was that AT&T was involved in the pro-

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CIRCLE 31 ON READER SERVICE CARD

ceedings in Justice Stafford's court.

O'Reilly's first legal tangle with Rood actually had taken place two years earlier in Springfield. When he set out to organize the stockholders, he hired a lawyer, Henry W. Ely. Just before the stockholder meeting of 1918, Ely received a check from Rood's attorney, Charles S. Ballard. A covering letter with the check read, "We understand that in acceptance of this check you are to make no further charge against this company or against Mr. Rood, for your time and attention to the annual meeting or for the time spent either with Mr. Rood or myself, in making preliminary plans for future action. We understand this applies only to preliminary details for you stated very clearly you would charge and expect to be paid for services rendered in carrying out our plans for the future. The control of O'Reilly's proxies, his actions or whatever he may say at the meeting we expect you to handle."

"In clearness of reproduction this wire instrument leaves nothing to be desired. The articulation could not be improved."—*The Scientific American.*



TRANSCRIBING. NOTE ABSENCE OF MACHINE (WHICH IS LOCATED IN A DISTANT ROOM). ONLY HAND CONTROL NECESSARY

Gab and Elapsing Patents

The Davis letter forced his resignation. In the meantime, Justice Siddons had taken over the case. Sullivan, who had replaced Ely, had a rather low opinion of the new judge, who spent an entire year on the case. "It's all gab, gab, gab as far as he's concerned," Sullivan told his clients. Finally, on June 27, 1927, the judge rendered a decision: there was need for a new receiver, and he appointed one. But since Rood's stock had been issued in exchange for faithful service, he was allowed to keep it—and with it the title and power of president.

The trouble was that time was running out for Telegraphone's stockholders. The Tiffany patent—their last remaining asset—had only five years to run. Once it expired, anybody could make a telegraphone.

By now, O'Reilly was dead and Rood was liquidating his landholdings in Ohio to keep himself and his company afloat. Sullivan, not one to give up easily, finally managed to approach Sen. Arthur Capper of Kansas one day in 1930. Capper was a member of the Senate Patents Committee, and Sullivan showed him the seized records, the Davis and Ely letters, and suggested that Congress could protect the stockholders by extending the Tiffany patent eight years—until 1940. This would give the stockholders a chance to reorganize, refinance and begin manufacturing in a new plant. Capper examined the evidence and told the lawyer, "Unbelievable, were it not for undisputable documentary evidence." He agreed to try for an act which would extend the patent—but he pointed out that the last time Congress had done so was in 1890, and then only for a minor design patent held by a patriotic society.

Congress had other things on its mind in those Depression years, and it took nearly two years for Sen. Capper to persuade his colleagues to look into the affairs of American Telegraphone. Finally, on March 9, 1932, the Senate Patents Committee took up the matter. On the same day, the House Patents Committee was conducting hearings on the destructive powers of New York theatre critics.

In Springfield, Rood had passed his 92nd birthday, granting an interview to the Springfield *Republican* in which he boasted of walking the mile to and from his office each day, and crediting abstinence from food and drink for his longevity. The family gathered to help him celebrate. What the newspaper stories failed to mention was the tangled Telegraphone affair and that one by one the banks which held the mortgages on his real estate holdings were foreclosing.

When it assembled, the Committee on Patents faced a dramatic display.

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There was a Telegraphone, containing a recording of an Amos 'n' Andy broadcast made from a table radio next to it. Sullivan played the recording, then recorded the comments of the Senators. At their request, he demonstrated how easy it was to make deletions and edit the recording. There were exhibits of correspondence taken from what remained of the company's ransacked files. Rood did not appear, nor was he represented by counsel. Sullivan told the senators that he was "still living—but pretty near the end." The Committee raised the obvious question: who was back of what appeared to be a carefully planned suppression and why?

Why the Suppression?

Sullivan suggested that because it cost $50 to make a Telegraphone and $500 to make a Dictaphone, that the Edison companies could have good reason for wanting to suppress it. The phonograph manufacturers had pooled their patents in 1903 in order to limit competition. Had they also pooled forces to suppress the wire recorder? Adding to this speculation were references in Rood's correspondence to demonstrations of the telegraphone for the benefit of "the phonograph people."

Less secret, but much more puzzling, was the open hostility of the telephone interests. Sullivan admitted that this puzzled him until Col. H. Livingstone, a representative of American Telephone & Telegraph Co. testified in the Federal Court hearings that the Telegraphone was "a competent truth recorder of both sides of a telephone conversation and the voices of both speakers are not only recognizeable but undeniable, so that if the instrument be made available to the public, the immense illegitimate use of the telephone in corrupt business schemes and social duplicity would suffer."

Sullivan then quoted the manager of the New York Telephone Company as saying that one-third of his company's business would be lost if a recording device (a major anticipated use of the Telegraphone) were attached to Bell Telephone's equipment. That was his estimate of the number of secret or illicit transactions by phone—use by bootleggers during Prohibition, gamblers placing bets, illegal business deals and the like. During the 1920's, in fact, Bell Telephone began pressing state legislatures for laws forbidding the attachment of any unauthorized equipment or the use of recording equipment to telephone company property—a law which is still on the books in some states.


Charles D. R... Veteran Business Man, Obs... 92d Birthday Today

The stockholder spokesman then brought up the most sinister chapter of all—one we shall examine next time involving the sale of Telegraphones to

HE SPRINGFIELD DAILY REPUBLICAN, SPRINGFIELD, MASS.: WEDNESI

Pictures - Streets - Dwight St.

Landmarks Will Be Razed

Feb. 17 1937



(Republican Staff Photo)

The Springfield Five Cents Savings bank will demolish this four-story building at the corner of Dwight street and Harrison avenue and the two-story structure next to it on Dwight street, upon which it recently foreclosed a mortgage. The tenants have been given a month's notice to vacate. What is to be done with the land has not been decided.

the German Navy. While the Senators were sympathetic, they finally asked Sullivan, "How can you rectify mismanagement and misconduct in an eight-year extension which you were unable to do anything about for more than 30 years?" Sullivan had no answer, and Congress let the matter drop.

Two years later, Rood was dead, leaving virtually no estate. The loft on Dwight Street had been vacant for years, and the building was razed in 1937 to make room for a parking lot. The Rood homestead still stands on Bowdoin Street, a brooding Victorian hulk now a rooming house overlooking the city.

But it remained for that biography of shattered hopes, Scudder's Manual of Obsolete Companies, to deliver American Telegraphone's epitaph: "W.W. Millan, receiver of the above company located at 900 F St., N.W., Washington, informed us on May 14, 1936 that by court authority sold the American Telegraphone business which he was operating as receiver, and was about to state his account and ask leave to pay the money to the court. Mr. Millan stated that he did not now have or ever did have any control over the litigation which has been pending for more than 15 years, and does not know when it will terminate. Mr. Millan further stated that if there is anything at all for the stockholders, it will be so little as to be negligible." In a later entry, Scudder's successor, Robert D. Fisher added, "Mr. Millan died in 1937 and assets of the factory in Springfield were sold that year under court order. Assets $55,000. On December 7, 1938, Arthur E. Elgin of Millan & Smith, 900 F St., N.W. appointed substitute receiver."

NEXT ISSUE:

How the Telegraphone Helped Solve a 1912 Murder Case; and The Sayville Story, or How Germany Set Up a Spy Station on Long Island.

THE HISTORY OF RECORDING

By Robert Angus

PART 3: The Telegraphone's Finest Hour

Romance and commercial interest are combined in the plans of the American Telegraphone Company, located in this city, which is manufacturing what is claimed to be one of the most perfect machines for recording and transmitting the sound of the human voice that has ever been invented. Contained in a box not more than 18 inches square, the telegraphone is a complete instrument for taking records of anything from a short conversation to an entire opera, holding them indelibly by steel impression, for transmission in the exact tones in which they were given. For business dictation of letters it is claimed that it will furnish a system perfectly reliable and money-saving. Connected to a telephone it is claimed for it that it will record every word of a telephone conversation, and in this way it has already been of use to Detective William J. Burns in some of his most famous cases.

—*Springfield* (Mass.)
Daily Republican,
Sept. 15, 1912

Thus began a breathless account of the magnetic recorder developed by Valdemar Poulsen some 13 years earlier, the American Telegraphone Company, whose 45-man plant at the corner of Dwight Street and Harrison Avenue was licensed to make it in the United States, and a tantalizing hint of one of the telegraphone's most exciting chapters.

As with so much of the telegraphone story, how the *Springfield Republican* story got into print in the first place is a mystery. For the company's factory had produced only a few dozen functioning recorders by September, 1912, mostly at the insistence of H.P. O'Reilly and A.M. McCrillis, two Telegraphone stockholders who had set up sales offices for the company in a number of cities. Telegraphone president Charles Dexter Rood had been reticent about publicity on the machines and reluctant to release them—even to customers drummed up by McCrillis and Reilly. So reticent had Rood been about the telegraphone, in fact, that he had threatened publishers of scientific journals and textbooks with lawsuits should they publish anything about the machine, the Poulsen patents, or the principles involved in magnetic recording. The newspaper story thus would have appeared to have originated with the salesmen rather than with Rood. And apparently it was one of them who supplied William J. Burns (founder of the detective agency which bears his name) with a recorder in hopes of getting a testimonial.

Burns had been in the headlines for much of the summer of 1912, thanks to a gangland slaying which had occurred some two months earlier in midtown New York. Although the gunning down of gambler Herman "Beansie" Rosenthal had all the earmarks of a simple murder of one hoodlum by others, district attorney Charles S. Whitman was convinced that there was more to it than that. Whitman, an intensely ambitious man, eventually rode the Rosenthal murder to the governor's chair in Albany—with the aid of private detective William J. Burns. And Burns cracked the case with the aid of a telegraphone.

The Murder Story Unfolds

Here's how it happened. Monday, July 15, had been a typically hot, humid day in New York City. During the evening, it started to rain. At about 8 P.M., gambler Herman Rosenthal, proprietor of the Hesper Club on West 45th Street, took a cab downtown to call on Whitman.

Beansie, it seems, had a partner in the Hesper Club—one Charles Becker, police lieutenant in charge of Special Squad Number One, a team responsible for ridding midtown Manhattan of gambling and prostitution. Becker had become a partner a few years before when he paid a call on Beansie and informed him that henceforth the Hesper Club wouldn't be bothered by police raids. Beansie wasn't too thrilled with the arrangement, but since it was a common one in the neighborhood, he put up with it. Soon, however, Becker was demanding a bigger slice of the action. When Beansie demurred, the police raided the club. Rosenthal stood firm. The next time the police came, they smashed the furnishings. Then Becker moved a patrolman into the Rosenthals' apartment on a 24-hour basis. Finally, the gambler gave in.



Herman "Beansie" Rosenthal "Gambler Talks"

Becker, the police department, and the city administration which tolerated this kind of goings on were all Democrats, minions of Tammany Hall.

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The district attorney, however, was a Republican elected on a program of reform. He'd heard that Rosenthal had a big mouth and had made overtures to him. But until the cops smashed up his club, Herman wouldn't talk.

Beansie Sings

On the night of July 15, however, Herman was to sing like a bird for nearly three hours while Whitman took notes. Even Whitman hadn't suspected the depths of corruption and the payoffs revealed by the little gambler. Finally, he put Rosenthal in the cab at around 11 P.M., as newsboys in Times Square were already proclaiming that "Gambler Talks." Whitman thoughtfully had passed the word to reporters before Rosenthal left his office.

The headlines didn't bother Beansie. In fact, he strolled into the Cafe Metropole on 43rd Street carrying a paper and telling anybody who didn't already know that he was the man in the headline. The crowd at the Metropole included other gamblers, pimps, prostitutes and denizens of New York's underworld who gave him the deep freeze. Nobody spoke to him; old friends turned away when he started a conversation. Nevertheless, Rosenthal cooled off in this chilly atmosphere until 2 A.M., when somebody called him outside.

He stepped onto the sidewalk, momentarily blinded by the lights of a theatre marquee. "Over here, Beansie," a voice called from across the street. Rosenthal took a step off the curb, and four shots caught him in the chest. A fifth blew off the top of his head. By the time the crowd from the Metropole had gotten out the door far enough to see what was happening, a car was speeding eastward at the other end of the block.

Whitman, roughly awakened, took charge immediately. He demanded that any evidence turned up by the local precinct be turned over to him personally. As luck would have it, two young visitors to the city were walking along 43rd Street at the time of the crime. They heard the shots—like the sounds of a car backfiring—then an open car raced past them. One of the witnesses had the presence of mind to copy down the license number, which he turned over to the policeman on the beat. The cop took his name and address as well.

The next day, the newspapers reported that the police had turned up no witnesses. One of the out-of-towners showed up at Whitman's office to say that his friend had copied down the license. The precinct commander then told Whitman that, yes, they had been given a license number, but they'd lost it. They'd also apparently lost the witness. He was nowhere to be found, and it was several days before the district attorney discovered that he was being held by the police.

Whitman quickly realized that if the Rosenthal killing were ever to be solved, he would have to do it himself, in spite of the police force. "Outside sources," dedicated to reform and reputed to include the financing of J.P. Morgan, raised funds for him to hire his own investigators and provide funds for his own staff. One of Whitman's first moves was to put William J. Burns on the case. Burns wasn't hampered by the restrictions under which the D.A.'s staff—and presumably the police—had to operate.

Rosenthal, Whitman and Burns were news—and someone from American Telegraphone was convinced that the linking of the new recording device would provide just the publicity needed to capture the popular imagination. So somebody supplied Burns with a telegraphone. The detective connected it directly to one of his telephone lines "so that an operative can dictate his report directly to the machine instead of having to come back to the office to do so. The machine seems to be well suited to his purpose."



Lieutenant Charles Becker

In addition, the Burns agency was making money available for underworld informants who had anything to say about the killing. Their voices, too, were recorded, and several anonymous callers later were identified by their voices on the wire.

Detective Burns and the Telegraphone

The license plate jotted down by the eyewitness led eventually to Billiard Ball Jack Rose, a strongarm collector for Becker. Rose in turn implicated Big Jack Zelig, a killer from the Lower East Side, who brought along four friends, Gyp the Blood Horowitz, Dago Frank, Lefty Louis and Whitey Lewis, to do the job. According to them, Becker gave the orders for the killing, saying, "Kill him anywhere. Do it in front of a policeman and it'll be all right. I'll take care of everything."

Zelig's four gunmen were tried, convicted and electrocuted. But the evidence brought forth in their trial added to the public pressure for an indictment against Becker. It was during Becker's two trials that Burns provided the evidence which helped result in convictions for Whitman. And it was his handling of the Becker case which sent Whitman to Albany as governor in 1914.

Just why American Telegraphone failed to capitalize on the notoriety of the case remains a mystery. When asked about the case and the telegraphone



Becker jury going to lunch.

in 1974, a representative of William J. Burns International Security Services said he had no information on the incident, but confirmed the possibility of the story's truth.

The Sayville and Tuckerton Telegraphones

Barely three years after the incident on 43rd Street, American Telegraphone was involved in another incident, in which publicity very definitely was not wanted. It seems that beginning in 1912, the Telefunken Company of Germany had been engaged in the erection of two shortwave stations in the United States, one at Tuckerton, N.J., ostensibly owned and operated by the Goldschmidt Wireless Telegraph Company; the other at Sayville, L.I., N.Y., ostensibly owned by Atlantic Communication Company, but sporting a giant sign proclaiming that it had been built by Telefunken. Both of these stations were linked with POZ, a shortwave station near Nauen, Germany, and were ostensibly designed to handle commercial messages across the Atlantic. They were, in fact, the first commercial transatlantic shortwave stations in the world.

Both stations utilized the most advanced radio equipment and construction techniques. In fact, their transmitter towers were the first in North America to use the ball-and-socket base now used for transmission towers throughout the world. And both had advanced message-sending equipment, including automatic transmission systems using perforated paper tape and telegraphones. The idea was that an operator could record a message at normal speed on tape or wire. Then the recording could be played over the air at high speed to another recorder across the ocean. Later, an operator on the receiving end could replay the recording at normal speed to transcribe it. This method had two prime virtues: it was highly efficient of transmission time, in that twice or four times as many messages could be handled; and if anybody chanced to eavesdrop, he'd be unable to make sense of the messages being flashed past him. When Atlantic Communication's manager A.E. Seelig was asked just how efficient the automatic transmission system was, he replied, "It is of such construction that we can send more rapidly than any operator could receive."

But the orders for the Sayville and Tuckerton telegraphones came not from Atlantic Communication or Goldschmidt, or even from Telefunken. They were ordered by the German Imperial Navy, along with several units for use on naval ships, and were delivered in the summer of 1913. Actually, the German Navy was one of a few lucky customers ever to receive the telegraphones it requested.

Although he was a German national, Dr. Goldschmidt had worked for Westinghouse before going into business for himself. With the aid of financing from Germany, Dr. Goldschmidt built his station around the Goldschmidt Alternator, a device not unlike one developed by telegraphone inventor Valdemar Poulsen.

In those early days of radio, there was no provision that prevented foreigners from owning, building or buying radio stations in the United States—an oversight Congress hurriedly corrected, at the urging of Sen. Cabot Lodge.

In any case, by July 5, 1913, Goldschmidt was ready to communicate experimentally with Nauen, and less than a year later, on June 18, 1914, the 820-foot tower at Tuckerton was beaming a message of goodwill from President Wilson to Kaiser Wilhelm.

At the same time, Telefunken was hard at work on a site beside the Long Island Railroad tracks in Sayville, Long Island. First there was a little white operations building, next a sign proclaiming "Telefunken," and finally a 500-foot tower. On January 27, there was an inaugural transmission featuring an exchange of messages between President Wilson and Kaiser Wilhelm. On the day it opened, the station still displayed its advertisement for Telefunken, despite the passage of the Communications Act of 1913. A reporter for the *New York Times* wanted to know how, in light of the new law, a foreign-owned station stayed on the air. A Telefunken spokesman at the company's Broadway office answered, "We have no interest in the station. It has been purchased by U.S. interests."

Pursuing the subject, the reporter found that the new owner was the Atlantic Communication Company of 90 West Street. Atlantic's manager, A.E. Debec, said that his firm was made up of American stockholders who had purchased the Sayville plant "with some German capital." Atlantic's president was Herman Metz, then just finishing his first term in Congress after a career that included the making of a small fortune as importer and manufacturer of dyestuffs and drugs. Most of his business contacts were in Germany, and he represented such German interests as I.G. Farben, BASF and Agfa in the United States. The two latter firms were later to become active in the manufacture of recording tape.

Two Related Events

Under Metz, Atlantic Communication began taking commercial messages for transmission to Europe, and relaying messages from the Continent. Then on August 3, two apparently unrelated events occurred. The German Lloyd liner *Kronprinz Wilhelm* left her berth in the North River for a seemingly normal run to Bremerhaven. However, she had been provisioned for a long stay at sea and was loaded with coal up to the level of her deck. On the main deck was a huge crate of what appeared to be electrical equipment. Nobody thought much about it until

some ten days later the *Kronprinz Wilhelm* seemed to have disappeared from the face of the earth. She had not been reported sighted by other liners on the transatlantic run, and she certainly hadn't arrived in Bremerhaven. Yet the Lloyd line seemed unconcerned.

The second event was Germany's invasion of France. England immediately moved to support France and cut the extension of the transatlantic cable from England to Germany, leaving Tuckerton and Sayville as the only direct links between the U.S. and northern Europe. The predictions of Senator Lodge less than a year before seemed to be coming true and Washington had the excuse it was looking for. Censors—two Navy wireless operators—moved into Tuckerton on August 7.

Meanwhile, Germany had found transmission from Sayville's 500-foot tower unreliable, particularly in periods of high sunspot activity. The answer was a mid-Atlantic relay station that picked up the Sayville station and relayed it to Nauen. When the story was told to the newspapers, the *Times* man asked if the *Kronprinz Wilhelm* were being used for this purpose. "You've guessed it," replied an Atlantic Communication official.

The next step was to examine the financial structure of Atlantic Communication a bit more closely. Since Atlantic appeared to be an American-owned company, it had received a license to operate. The investigators found, however, that while Metz was the president, Dr. Karl George Frank, a German national, was the secretary-treasurer and actual head of the firm. Metz, it developed, was the only American to own stock in the company, and his holdings were only enough to qualify him as a corporate officer. The balance of the stock was held in Germany by arms of the Telefunken combine. In charge at the transmitter was a German naval officer, Captain Zenneck.

Toward the end of August, Secretary of the Navy Josephus Daniels discovered that Tuckerton was operating without a license. So he ordered it seized and closed. On September 10, the station reopened, manned by U.S. Navy personnel. Whether the Navy seized Tuckerton's telegraphone along with the other equipment or whether it was taken out by the German operators nobody ever knew, because the Navy clamped a lid of secrecy on the entire operation.

A High-pitched Buzz

Almost coincidental with the closing of Tuckerton, ham radio operators along the East Coast were detecting a high-pitched buzz that went on the air every night at exactly 11 P.M. when Sayville began its transmissions to Germany. One particularly poetic ham described it as "a musical note like the buzzing of a titanic bumble bee which sped through space." Nobody seemed to know what it was, but hams agreed it came from Sayville.

On the morning of May 7, 1915, Americans awoke to find that German U-boats had sunk the Cunard liner *Lusitania* off the Irish coast, taking with her a large number of American passengers. Within hours, reports were circulating that German newspapers had known in advance that the *Lusitania* would be sunk, and where. The Berne correspondent of the

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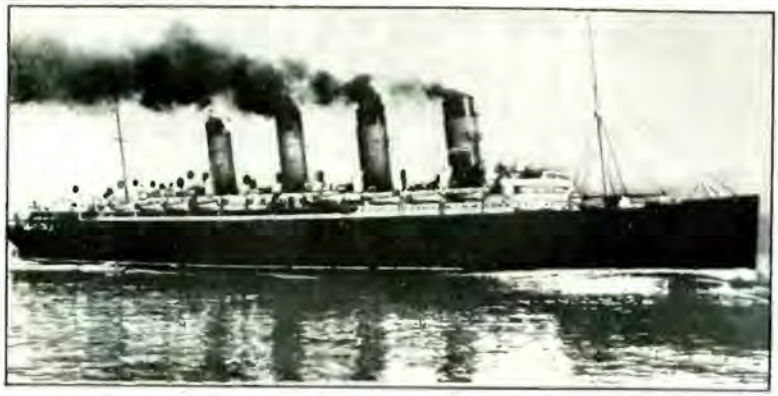
London *Morning Post* wrote that they had received the news by wireless from New York in advance of the sinking and had their stories already written. In New York, Carl Schurz Jr., spokesman for German interests, told the New York *World* that the Germans had been alerted by wireless to the presence on the *Lusitania* of war supplies for Britain when the ship left New York on May 1. Because Germany was at war with Britain, he said, the U-boats had only been protecting themselves in sinking the ship.

If the reports were right, there was only one way the U-boats could have gotten the word—from Sayville. The next day, such anti-German newspapers as the *Providence Journal*, Brooklyn *Daily Eagle*, New York *World* and *New York Times* were calling for the closing of Sayville—or at least much stricter control over its activities.

Meanwhile the mysterious sounds continued to be heard. After establishing contact with Nauen, the operator would begin sending so fast that the message became unintelligible. But not all transmissions fell into this category. Between 11 P.M. and 5 A.M. Sayville sent a full schedule of commercial messages at normal speed. The *Providence Journal* stationed a crack telegrapher at its experimental radio station at Point Judith, R.I., with instructions to transcribe every word sent out by Sayville.

By the end of June, Navy Secretary Daniels ordered three lieutenants into Sayville as censors with instructions to hold up every message they couldn't understand. The censors did stop a number of what appeared to be commercial messages using code words or referring to British or German ships, but reported nothing else wrong. Almost immediately, rumors began circulating that the German operators simply waited until the censor on duty went out for a smoke or coffee break before sending the coded messages. Lt. Clark, one of the censors, denied it.

On July 1, the *Providence Journal* lowered the boom by publishing the first in a series of what it said were Sayville transmissions. Specifically, the *Journal* charged that Nauen had been requesting more repeats of messages lately, allegedly due to faulty reception. But when the repeats came there often were rows of numbers that had nothing to do with any previous transmission. Prices from the New York Stock Exchange and Cotton Exchange bore no relation to actual transactions. The cotton orders, the newspaper claimed, were concealed reports of European troop movements.



The *Lusitania* leaves New York harbor on her final voyage.



The infamous Telefunken transmitting tower on Sayville, L.I.

Bumble Bee Code Deciphered

But the Providence newspaper wasn't the only one listening in on Sayville. In Westfield, N.J., lived Charles E. Apgar, a ham radio operator and something of an electronics experimenter. He had developed a device he called an Amplifone which permitted him to record signals off the air onto an Edison dictating machine. On the night of June 7 he had made his first cylinder of the mysterious bumble bee sounds. He was unable to make any sense from the transmissions, though, until one night the Edison machine began to slow down as he was playing a cylinder. Apgar listened intently as the bee drone resolved itself into dots and dashes. Taking a pencil, he wrote down what he heard, then got a German-English dictionary.

What he found sent him hurrying the next morning to the offices of L.R. Krumm, the chief radio inspector of the Bureau of Navigation's New York office. Apgar showed him the messages and played a few of the cylinders. Krumm was not a man to be alarmed easily, but he hurriedly sent for William J. Flynn, head of the U.S. Secret Service. Together the three men listened to the cylinders as Apgar tried to slow down his machine. Although none of them knew it at the time, they were listening to a Telegraphone used as its inventor had envisioned—to provide more efficent use of the airwaves by cramming four messages into the time it normally took to send one; and to confound eavesdroppers by presenting them with a meaningless hum.

It wasn't until after the war that anyone disclosed what Apgar had recorded. Even then, nobody was providing complete texts. As an example, however, a spokesman cited what appeared to be a commercial message reporting that a cargo of sugar had been shipped on a particular vessel and bills of lading were going forward by hand. Another message announced the birth of a baby, the date and the fact that

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Charles E. Apgar, the ham radio operator who decoded the mysterious bumble bee sounds.

the child had been christened Mercedes. The Secret Service determined that there was no sugar aboard the ship mentioned. But the ship did have a passenger named Mercedes and when it docked in Liverpool, she was met by two men. British police arrested all three and confiscated the documents ("bills of lading") the lady was carrying.

On July 6, Captain W.H.G. Bullard showed up at Sayville with orders from Secretary Daniels to seize the station. Nobody was more surprised than the three Naval officers who had been on duty there. The Germans weren't caught napping, however. A Brooklyn *Eagle* reporter who had camped in a field across the railroad tracks the day before reported that cartons and crates were trucked out after dark on the night of the 5th. Some were described as too large and too heavy to contain papers or files. The Navy men said they hadn't noticed anything unusual during their entire tour of duty that day.

Bullard's first act was to clamp the same lid of secrecy on Sayville that he had imposed on Tuckerton. What became of the telegraphones at both stations remains a mystery to this day, although some of the records from both stations can now be seen in the National Archives in Washington, D.C.

Altogether, the Imperial German Navy ordered half a dozen telegraphones, including the Sayville and Tuckerton units. One of the others found its way aboard the U-boat *Deutschland*, where it was photographed during a goodwill visit by the ship to Baltimore in 1915. What became of the others is even more shrouded in mystery.

Was Rood a Collaborator?

When he saw the picture, Dr. William D. Tracy, a Telegraphone stockholder living in New York, fired off a letter to Rood demanding to know how the Germans had gotten the telegraphones when salesman McCrillis couldn't. Rood replied that he didn't know anything about any sales to the German government. But a Congressional investigation showed that two years prior to Dr. Tracy's inquiry, Rood had expedited the order himself, marking them "for the German Government." The order itself had come by way of Denmark.

Three years later, with the United States already in World War I, Rood was to turn down yet another potential customer. This one was the U.S. Signal Corps, which requested a demonstration of the telegraphone, to determine whether it was suitable for recording messages in the field. Rood replied that the company still was experimenting with the machine and discouraged any order. He suggested that such a use would be in the nature of an experiment, even though the Secret Service and the Navy knew that the Germans had been using their telegraphones in just this way for four years.

The Signal Corps wouldn't take no for an answer. Finally, in September, the company delivered the first four machines. During the construction period, Rood asked to be advised as to the proposed use of the equipment. It was alleged later that he actively sought intelligence data which conceivably would be recorded on the machines. His inquiries, a Senate committee was to be told, included details on where the machines were to be placed, whether it would be in France or elsewhere, and under whose personal supervision they would be operated. Later testimony indicated that Rood had been given secret information on the movements of the U.S.S. *President Lincoln* prior to its torpedoing on May 31, 1918.

When the four machines finally were delivered "in some kind of condition," according to a witness, they failed to work. "Nobody has ever been able to trace the cause. I have tried to find out," attorney George E. Sullivan told the Congressional investigators.

To top it off, American Telegraphone's most satisfied customer, DuPont, decided to trade in its machines for the "new model" promised in 1918 by Rood. During the final year of the war, DuPont sent all 20 of its machines back. The ones it received in exchange "were defective in materials and workmanship." After struggling with them for nearly two years, DuPont junked the lot and turned to the more reliable dictaphone.

NEXT ISSUE:

Between the Wars — 1920 - 40.

THE HISTORY OF RECORDING

By Robert Angus

PART 4: Between the wars —1920-40.

Valdemar Poulsen's patents for a device which could record sound on piano wire expired in 1918, just as World War I was drawing to a close. Poulsen, the Danish telephone engineer who had given birth to magnetic recording some 20 years earlier, had forgotten this particular invention and gone on to others. In Springfield, Mass., the man who was charged with the responsibility of making magnetic recorders, Charles Dexter Rood, was engaged in lawsuits and wrangles with the stockholders of the American Telegraphone Company, which Poulsen had founded and which he headed. At 78, he was employing more lawyers than factory hands.

Bleak as things looked for the future of magnetic recording, the telegraphone was anything but dead. Rood had delivered a number of telegraphones to the Imperial German Navy, which used them to advantage throughout the war to transmit messages at high speed in a code which proved very difficult to crack. Kurt Stille, a businessman, was one German who believed in the potential of the telegraphone as a business machine. He talked financiers into forming a patent-holding company to sell rights to manufacturers who wished to make magnetic recording machines.

One Stille disciple was Max Kohn who, in 1921, produced a telegraphone with a built-in amplifier using electron vacuum tubes. Poulsen had created an electromagnetic recording system, but had provided no way of amplifying the playback of a recording. Accordingly, until the Kohl machine came along, listeners had to plug headphones into the telegraphone to be able to hear anything. This fact alone probably accounted for its failure to replace the phonograph as a home entertainment medium. The Kohl machine substituted 5¼-inch steel discs for Poulsen's piano wire. Kohl recognized the limited fidelity possible on magnetized piano wire as a real handicap. Beginning in 1920, other German scientists began experimenting with strips of magnetic material—tape—instead of wire. In addition to improving the frequency response, the scientists discovered, tape permitted slower speeds, and a consequent lengthening of recording time. Poulsen's telegraphone utilized two magnetic pole-pieces placed on opposite sides of the wire and offset with respect to each other. The magnetic pattern in the wire thus consisted mainly of a variation in the intensity of magnetization, the direction of the magnetization being substantially parallel to the axis of the wire. This method of longitudinal magnetization required very high speeds for minimum fidelity—with the wire frequently travelling at speeds of six to ten feet per second. By using



The AEG Magnetophone used to record the first concert on tape.

tape instead of wire, it would be possible to place the pole-pieces directly opposite each other so that the magnetic pattern consisted of variations in the intensity of magnetization, the direction of magnetization being substantially perpendicular to the surface of the tape. Theoretically, perpendicular magnetization could produce reasonable fidelity at a tape speed of 16 inches per second.

Of course, to record on magnetic tape instead of wire, it was necessary to have tape. A. Nasavischwily, a German scientist, was experimenting with powdered iron oxide as a recording medium. Apparently nothing much came of his efforts, although Karl Bauer marketed a recorder later in the decade which used a form of tape instead of wire. Although Nasavischwily proved the feasibility of recording on iron particles, he couldn't produce a tape of the stuff suitable for use on a recorder.

Probably the most successful of the Poulsen-Stille offspring was the Echophone Company's Dailygraph, a compact wire recorder designed for business use. Unfortunately, fascinating as the little machine might have been technically, the economy of postwar Germany wasn't ready for such labor-saving devices. Thousands of stenographers were out of work, and it was cheaper for most businesses to hire a secretary than to buy a machine.

Then in 1927, Fritz Pfleumer, an electrical engineer in Dresden, borrowing the idea of coated tape from Oberlin Smith (the American scientific writer who started it all in 1888 with an article proposing magnetic recording) and Nasavischwily's idea of using powdered oxide as a recording medium, began gluing oxide onto strips of paper. Pfleumer's first efforts were primitive by any standards. The tape surface was rough and abrasive, and the glue he used to hold the coating in place less than satisfactory. When he put one of his tapes on an experimental recorder, the coating would fly from the machine in a fine spray as the tape sped past the playback head.

Tape Recording Possibilities

Nonetheless, he proved that tape recording was possible, and five years later approached Allgemeine Elektricitats Gesellschaft in Berlin with his idea, and signed a contract to work on the development of a tape recorder.



The first concert recorded on tape (1936).

Note mic directly behind conductor Beecham.

AEG determined to make the machines; to make the tape, it approached Badische Anilin und Soda Fabrik, a chemical manufacturer in Ludwigshafen, then a subsidiary of the giant I.G. Farben chemical combine.

But before things got under way in Ludwigshafen, there was one spectacular attempt to make a high fidelity recorder, this time using a steel band instead of wire. This machine was the brainchild of Prof. Ludwig Blattner, who managed to persuade the British Broadcasting Corporation to buy one, and sold others to motion picture studios in Germany and Britain. The Blattnerphone was used to record King George V's Christmas Message to the Empire in 1930. At the time, the sun didn't set on the British Empire, and the BBC needed a device which could rebroadcast the message at times convenient to listeners in Canada, Australia, South Africa and Hong Kong.

The job of coping with the machine fell to Lynton Fletcher, the BBC's former head of sound recordings. Fletcher described it as resembling two ancient Irish spinning wheels joined together. It used a steel band approximately a quarter-inch wide, travelling at a high rate of speed. Engineers could edit recordings by using a pair of metal shears and a soldering iron. "The result of this," Fletcher recalled recently, "was that, on at least one occasion, you'd hear the announcer say, 'This is Mr. H.C. Harbinger of South Africa,' then you'd hear a plop as the soldered joint went through the reproducing head, and you'd probably hear the voice of Stanley Baldwin."

The Blattnerphone arrived in England in the charge of a young technician named Von Heusing. "There was only one engineer, there was only one machine," Fletcher continued. "Both were extremely temperamental. Even in those early days we knew that what mattered in making a recording was that the machine should run at the same speed when it was being played back as it had run when the recording was being made. This the Blattnerphone flatly refused to do." H. Burrell Hadden, a Canadian audio consultant, then a young BBC engineer, recalled that every so often the splices would come unsoldered, and everybody in the studio ducked to avoid being decapitated by bands of flying steel.

In the United States, two U.S. Navy scientists—W.L. Carlson and G.W. Carpenter—happened on the idea of using alternating current bias instead of the direct current bias incorporated in the telegraphone. AC bias had two advantages—it cut down on noise during the recording process, and insured the permanence of recordings. There's no evidence that Carlson and Carpenter ever saw a telegraphone, but the Navy apparently seized two as part of the property of short wave radio stations set up by the German Navy in Tuckerton, N.J. and Sayville, L. I., N.Y. During the 1920's and 1930's, the Navy seemed to be the only organization in the United States seriously interested in magnetic recording.

Even the U.S. Navy's interest in magnetic recording was lukewarm compared to that of Wilhelm Gaus, the inventor of the Gaus cell and BASF's chief physical chemist. Gaus was entranced with the idea presented by Fritz Pfleumer, and arranged to make laboratory facilities and money available to enable Pfleumer to get his magnetic tape into production. The company persuaded Pfleumer to abandon his attempts to coat paper and use cellulose acetate film instead. Acetate was a product BASF was making for the motion picture industry, and the company already had a technique for coating the film. After some 18 months, AEG issued a report confirming that the magnetic recording tapes supplied by Ludwigshafen met all the company's requirements, and that AEG recorders together with BASF tape would be shown at the 1934 Berlin Radio Exhibition.

The Stahltonmaschine

The year before, Ludwig Blattner had merged his interests with Marconi Radio and Stille to create a vastly improved machine. At the same time, the C. Lorenz Company had acquired the rights to the Dailygraph, and marketed an improved version of it under the trade name Textophone. The following year, Lorenz, by now a subsidiary of International Telephone & Telegraph, introduced the Stahltonmaschine, a steel tape recorder similar to the Blattnerphone. Like the Blattnerphone, it was put to work in radio, this time within Germany. The man who worked on the Textophone and headed the development of the Stahltonmaschine was S. Joseph Begun, Lorenz's youthful chief engineer. Begun learned all there was to know about magnetic recording at the time, then fled Nazi Germany in 1935 for a future in America. The Stahltonmaschine's steel tape was 3mm wide and ran at a speed of 47 inches per second, producing a frequency response up to 5,000 cycles per second.

At AEG and I.G. Farben, enthusiasm was building for the coup both companies expected to score at the Berlin show at the end of August. The recorder's handiness and compactness led company sales executives to speculate on all sorts of possible uses, including the elimination of the gramophone as a medium of home entertainment. Production started on July 1, and by the beginning of August, Farben had supplied AEG with 30,000 feet of tape. Press releases were written and duplicated, one of them proclaiming, "An instrument with the registered trade name Magnetophone will be displayed at the Radio Exhibition. It is the result of years of development by AEG, and its production has now commenced."

Then suddenly, just a week before the Exhibition, the recorder was withdrawn, information intended for the press was recalled and suppressed, and the delivery of tapes to Berlin stopped. The company didn't say so publicly, but the reason was unexpectedly strong interference within the recorder itself once it was assembled. Besides, AEG had hoped to compete with ITT's Stahltonmaschine—but its tape speed was about the same and its frequency response half that of the steel band unit. AEG's engineers returned to the drawing board to see what they could do about boosting the frequency response. At Farben, Pfleumer and a young assistant, Hans Seiberth, began experiments on improving the consistency of one batch of tape, compared to the next.

Two months after the Radio Exhibition, AEG management inspected an improved version of the recorder. On the basis of the improvements, the engineers were told to carry on. After a further eight months, in the summer of 1935, the electronic experts proudly announced that they had constructed a new recorder operating on completely new principles. They said that they had tested each individual part, and that the prototype was nearly ready. They were confident that, allowing for human errors, the new design would meet every demand placed on it and that it would be ready in time for the 1935 Radio Exhibition.

However, the project abruptly became involved with Farben internal politics. The BASF plant at Ludwigshafen was in the process of producing some 165,000 feet of tape, an incredible amount at the time, and found itself running out of acetate film. Accordingly, Gaus asked for permission to start making film in Ludwigshafen instead of buying it from the Farben plant at Wolfen. Wolfen already was making film for the movies, and had developed Igephon, a transparent film on which sound could be recorded with a phonograph stylus. Reichs Rundfunk Gesellschaft, which had been using the Stahltonmaschine for radio broadcast, was known to be dissatisfied with the steel band because of its weight, cost and the high recording speed it required; the company had been considering both the Magnetophon and Igephon as a replacement. Igephon tape was being manufactured to fit a recorder developed by Philips of the Netherlands, a recorder which would be used experimentally by the Columbia Broadcasting System in New York in 1938.

The Wolfen plant was all ready to start supplying Reichs Rundfunk and other broadcasters with Igephon, and it didn't want any competition from magnetic tape. In Ludwigshafen, Gaus, Pfleumer and Seiberth were convinced that they had the superior recording system, because their tape was easier to edit, higher in fidelity, capable of unlimited re-use, and suitable for use in both stationary and mobile units. Whichever system the broadcasters chose, however, they would have to deal with I.G. Farben.

Gaus and his subordinates won the battle, simply by ignoring directives from Farben headquarters. When the 1935 Radio Exhibition opened, there was the AEG K-1 Magnetophon on display and BASF tape to go with it. The recording cost per minute was 15 cents, while the Stahltonmaschine used about one dollar worth of tape per minute.

Wrote one company observer of the reaction, "Dealers and other interested people literally stormed the demonstration room, so that we were forced to close the door temporarily. Within a few hours, the first eight recorders were sold. If they survive the exhibition, we can say that the re-

corders have adequate mechanical stability, because they have to stand a lot of rough treatment."

First Concert Recordings on Magnetic Tape

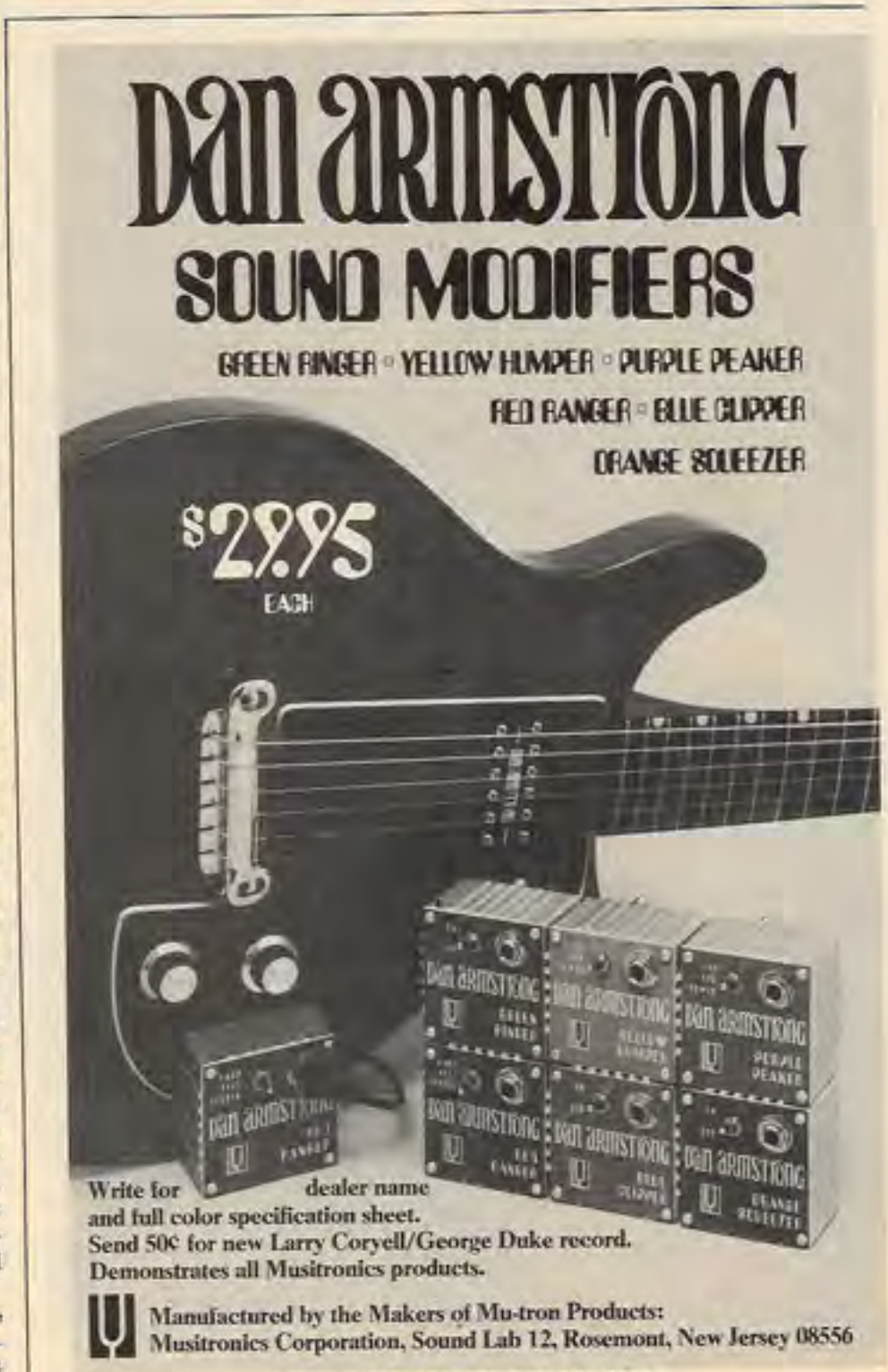
Actually, it wasn't until January, 1938, that German Radio switched over to magnetic tape. During the first year, it consumed more than four million feet of recording tape, much of it used to record complete operas, symphonic concerts, dance music and background music for later rebroadcast. It is from these tapes that many early long-playing records released in the United States were derived. One example was a *Hansel und Gretel* recorded in 1938 by Radio Berlin with Erna Berger and released by Urania Records some 14 years later. Another featured Richard Strauss conducting the Vienna Philharmonic in *Der Burger als Edelmann*, also released in 1952 on records by Regent.

However, the first symphony orchestra to record on magnetic tape was not German, but British. In November 1936, Sir Thomas Beecham and the London Philharmonic were touring Germany. On the night of November 19, they were scheduled to perform in Ludwigshafen, as one in a series of concerts sponsored by I.G. Farben for its employees. Farben officials saw in the concert a perfect opportunity to try out a new black oxide tape they'd just developed, and to prove just how wide-range the fidelity of the tape system really was. Accordingly, they set up a microphone and recorder to capture as much of the concert as possible. The result was two 15-minute excerpts, representing the recording capability at the time, which are still extant today.

Seiberth, who retired recently after spending more than 35 years making tape, recalls that one early problem was maintaining quality control. Sophisticated measuring instruments simply didn't exist, and nobody knew exactly what to measure, anyway. "There was a Herr Roebel who was in charge of those things," he remembers. "Somebody would record a sustained piano tone on a sample tape, and Herr Roebel would listen to it. If it sounded good to him, he passed the entire lot. 'Listening by ear is good enough,' he used to say.

"When we were getting started, we had two names for the system—Magnetophon and Ferrotone. AEG apparently preferred Magnetophon, because that's the one they chose. Otherwise, the tape recorder might be known as the Ferrotone today."

Asked how tape widths and speeds came about, Seiberth said they were equally arbitrary. "We made the first tape 6.5 mm wide, because that's what AEG asked for. Later, they went to 6.25 mm, but decided that was not quite right, so we and they settled on a width of 6.3 mm. That translates roughly to a quarter-inch. It was as simple as that. When it came to selecting a tape speed, that was determined by the speed of the motor and the diameter of the shaft. We were using 50-cycle current, and shafts with a diameter of 10 millimeters. That meant a tape speed of 77 centimeters per second, or 30 inches per second. Then as technology permitted, we simply cut the speed in half—first to 15, then to 7½, 3¾ and finally to



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1⅞ ips—to get more recording time on each reel." By the same token, Seiberth explained, the reels on the K-1 were 18 centimeters in diameter simply because that was the size that fit. Initially, it was possible to record for 15 minutes, but by varying the diameter of the hub, it was possible to increase playing time to 22 minutes.

The K-1, designed for professional use, spawned a number of special-purpose Magnetophons, including low-cost, low-fi portables for use by correspondents, dictating machines, and even a model designed for home use in addition to the hi-fi version designed for German radio. AEG and BASF engineers presented papers on their achievements and explained how their machines worked—papers which were ignored by the scientific community outside Germany.

Developments in the U.S.

Meanwhile, work was going on (albeit on a very limited basis) on magnetic recording in the United States as if the German developments had not taken place. The work of Carlson and Carpenter was part of an ongoing Navy research project into wire recording which extended through World War II. The Navy's interest was in transmitting messages at high speed—exactly as telegraphone inventor Valdemar Poulsen had intended, and as the Germans had done from their radio stations in Long Island and New Jersey. There were some independent producers as well, including S.J. Begun, who fled Germany in 1935 to go to work for the Brush Development Company of Cleveland. Since Begun had designed the Lorenz Stahltonmaschine, Brush put him to work on a low-cost home wire recorder. One of the first fruits of his new affiliation, instead, was an endless loop steel cartridge. Two years later came the first Brush Soundmirror, which also used steel tape. Nonetheless, Dr. Begun was dissatisfied with the steel medium. "We had almost nothing going for us with steel tape," he wrote. "It was difficult to make, expensive and hard to handle. In fact its only advantage was that it could be recorded again and again."

By 1939, however, Brush had begun to coat strips of paper with oxide, for use in recording. The results were unsatisfactory. "The development of paper tape was just not far enough along and the military requirements were such that we could not go to a non-metal body," Dr. Begun recalled.

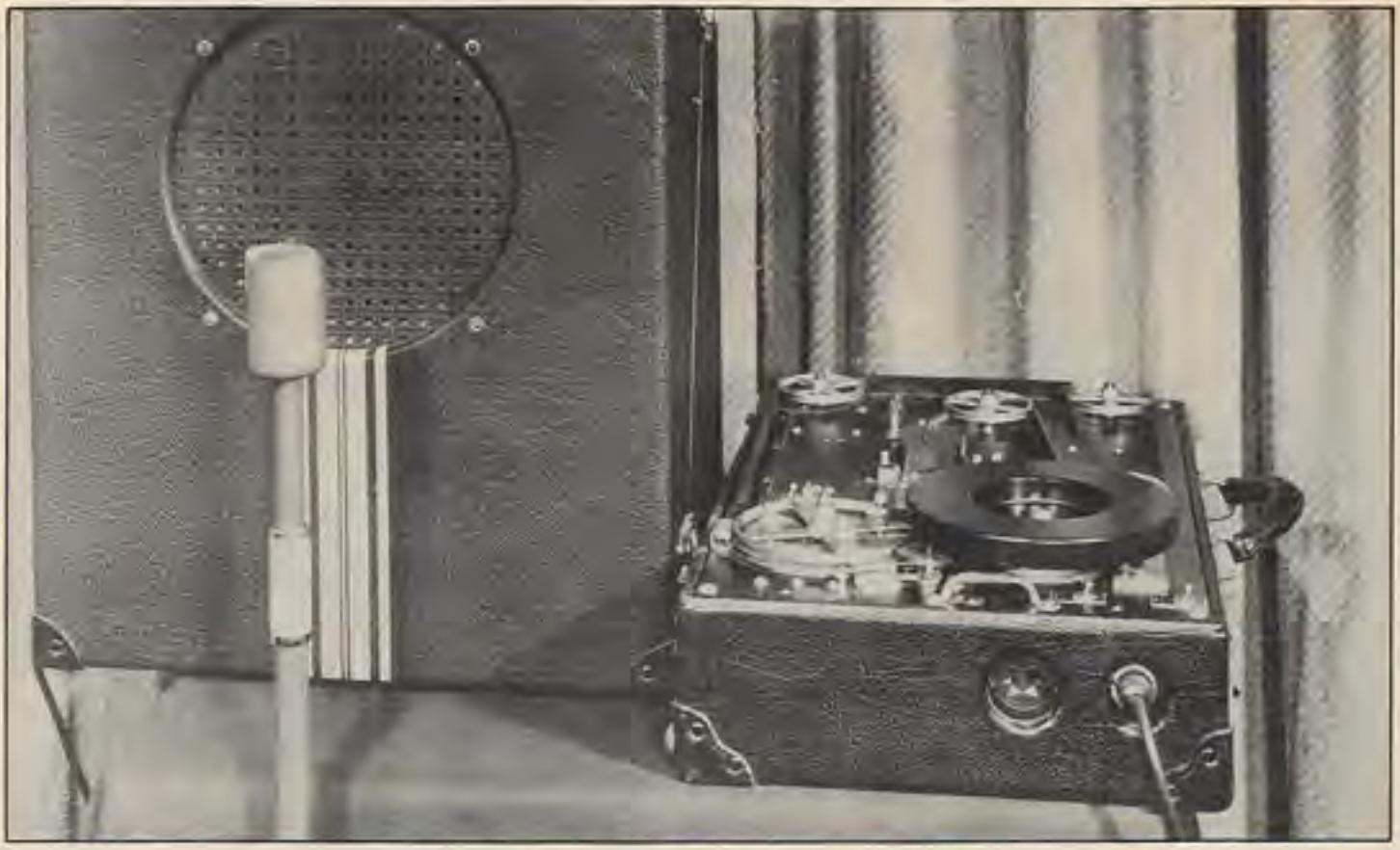
The Bell System was equally hard at work. In 1937, C.N. Hickman of Bell Telephone Laboratories described a magnetic recorder the Labs had developed for recording speech. It used a steel ribbon about 1.5 mils thick and 50 mils wide which could operate at a speed of eight inches per second. However, the recorder also operated at a speed of 16 inches per second, at which it could record frequencies up to 8,000 cps. In 1939, the machine was modified to accommodate two separate coils of steel wound side by side on the same reel. As the tape unwound, it separated so that each tape could pass by a separately-mounted playback head to produce stereo. The stereo machine was demonstrated at the Bell Telephone exhibit at the New York World's Fair.



Marvin Camras, examining magnetic recording equipment.

Training and Teaching on Tape

The Hickman machine was not Bell's first try at a workable recorder. Work had begun as early as 1933, with the intention of producing a device which could be used to train telephone operators by allowing them to hear themselves at work. Hickman published a paper that year discussing his early experiments. By 1935, Bell had such a machine, using steel tape. This machine, capable of recording one-minute bits of speech and reproducing them immediately, caused long lines to form at the New York and San Francisco World's Fairs, where it allowed fairgoers to hear themselves as others heard them for the first time. Jack Mullin, then a young engineer working for Pacific Telephone, recalls, "One night there was a demonstration for the employees of this thing. A man played a violin and you heard him play for one minute, then the playback for a minute. The quality was remarkably good. I was surprised that a magnetic



Bell Telephone Labs tape recorder (1938)

recorder using an endless loop of steel could sound so good. They used it for teaching operators the proper method of handling customers. In one minute, you can show an operator what she does or doesn't do right."

The steel band machine eventually became Western Electric's Mirrophone, which went into service in 1940 as a continuous weather-announcing device. The Mirrophone stayed in use until the 1950's, when it was replaced with an endless loop tape recorder.

One day in 1939, a junior at Illinois Institute of Technology was faced with a problem: his cousin was studying singing and needed a low-cost device which would enable him to hear himself as he practiced. There were disc recorders, of course, but the cost of blank discs was high and the machines were bulky and difficult to operate. So Marvin Camras began experimenting with a device which could record sounds on piano wire. By the time he graduated the following year, Camras had developed a machine which would record a wide variety of sounds for electronic playback. That wire recorder, which the student brought along to class to show his professors, was the beginning of a career which was to include a number of patents and professional honors.

Upon graduation, Camras was offered a job with Armour Research Foundation, an organization established by IIT faculty members to provide coordinated research for industry. In 1941, Armour Research applied for a patent on AC bias in magnetic recording. When war broke out late that year, Armour put Camras' wire recorder into production, later licensing General Electric and two other firms to make units to keep up with the demand. Altogether, some 10,000 of the Armour recorders were built. In addition, the military ordered more than 2,000 wire recorders from Brush.

Sketchy Beginnings in Japan

On the other side of the world, in Japan, there had been some research into magnetic recording as early as the 1930's. The first technical articles on the subject appeared in Japanese publications in 1936, with patents being issued in 1937 and 1940. The Tokyo Electro-Chemical Company (TDK) had been established in 1935 by a group of engineers who had developed ferrite, a new iron-oxide compound, and were trying to develop uses for it. Details on Japan's prewar research into magnetic tape are necessarily sketchy. Nevertheless, patents had been issued. With the appearance in Japan of the first Ampex tape recorders, the holders of the patents felt that their rights were being infringed upon. So in 1952 they persuaded the Japanese communications industry, Tokyo Tsushin Kogyo, to halt all import, use or sale of American tape recorders.

While World War II brought an abrupt halt to many electronics projects, it served as a stimulus to the development of magnetic recording, because the military in both Germany and the United States saw in it a technological communications tool which had practical value.

In the next issue, we'll see exactly what each side was up to during the war years, and what happened to men on both sides of the conflict—Hans Seiberth, the German scientist charged with keeping the tape flowing under the threat of Allied bombers, and Jack Mullin, the Signal Corpsman who brought back the first German recorder and put it to work in American radio.

NEXT ISSUE:
The War Years

THE HISTORY OF RECORDING

By Robert Angus

PART 5: Mr. Mullin's Machine and Mr. Orr's Brown Paper Bag

For most Americans, the story of the tape recorder goes back only to World War II when two men brought it forcefully to the American consciousness by returning from Europe with a working recorder and with the means of making tape for it.

The two men were John T. Mullin and John Herbert Orr, both serving with the U.S. Signal Corps in occupied Germany. Their stories are typical of the drama which has surrounded the development of magnetic recording since its very beginning.

Just before the Allied invasion of Europe in 1944, Mullin was assigned to a Signal Corps laboratory somewhere on the southern coast of Britain. His assignment: to eliminate interference caused in a radio receiver the army was using. The unit had been developed in the United States, where it worked perfectly. But when it reached Britain, radar signals which didn't exist in the western hemisphere at the time began playing hob with reception. "It was not a difficult thing to solve, and besides I was intrigued with the job," Mullin recalled recently. "As a result, I used to stay up until two or three in the morning by myself in the lab. For companionship, I turned to the AM radio nearby and tried to find some entertainment. The BBC used to sign off at midnight, so I'd begin fishing around the dial until I found something else. It didn't take me long to discover that the best entertainment and music at that hour came from Germany."

Indeed, entertainment poured forth from German radio 'round the clock, interspersed with news and propaganda. "The intriguing thing to me," Mullin remembers, "is that the music was well played and obviously at times played by very large orchestras. That went on, hour after hour, all through the night. Well, of course, Hitler could have anything he wanted in those days. All he'd have to do was to say, 'You stay up and play tonight'—and they'd do it. But that didn't seem reasonable, even for a madman. The amazing thing about this music was that there wasn't any record scratch or breaks every few minutes to indicate that they were playing records. I was intrigued. I wanted to know how they did it."



Bing Crosby, in typical attire for show day in 1950, beside Mullin's two Ampex Model 200's.

Mullin was to find out the following summer when, as part of a Signal Corps team, he was assigned the job of following the retreating German army, picking up any electronic items of interest. "Another man and I had the assignment of checking out a tower on a mountain several miles north of Frankfurt. There wasn't much left when we got there, but there was a British officer on the same kind of assignment as ours. We walked around together, and somehow the subject of records and music and recording came up. He asked me if I had heard this machine down at Radio Frankfurt. I had heard tape recorders before—we'd been picking up abandoned battery portable jobs all across Europe behind the retreating Germans. So when he told me that this was a tape recorder, I thought that probably his ears weren't very good.

"When you come down the road from that mountain, you come to a main highway at the bottom. If you turn right, it takes you back to Paris. If you turn left, you're on your way to Bad Nauheim, which was where Radio Frankfurt was actually located. When we got to that junction, I turned left, following the guy's advice. That was probably the greatest decision of my life."

Radio Frankfurt at the time was being operated by the Armed Forces Radio Service. When Mullin and his companion pulled in late in the afternoon, they were greeted by the Signal Corps officers in charge. "They spoke in German to an assistant who clicked his heels and ran back into a room and came out with a roll of tape and put it on the machine. That's when I really flipped, because I had never heard anything like that. To my knowledge, there just hadn't been anything like that in recording before. You couldn't tell whether it was 'live' or playback, there was no background noise. I was thrilled. The man with me had a camera, and we went to work and photographed all the instruction manuals and all the schematics and took them back to Paris."

The Signal Corps wanted two of everything, so Mullin quickly rounded

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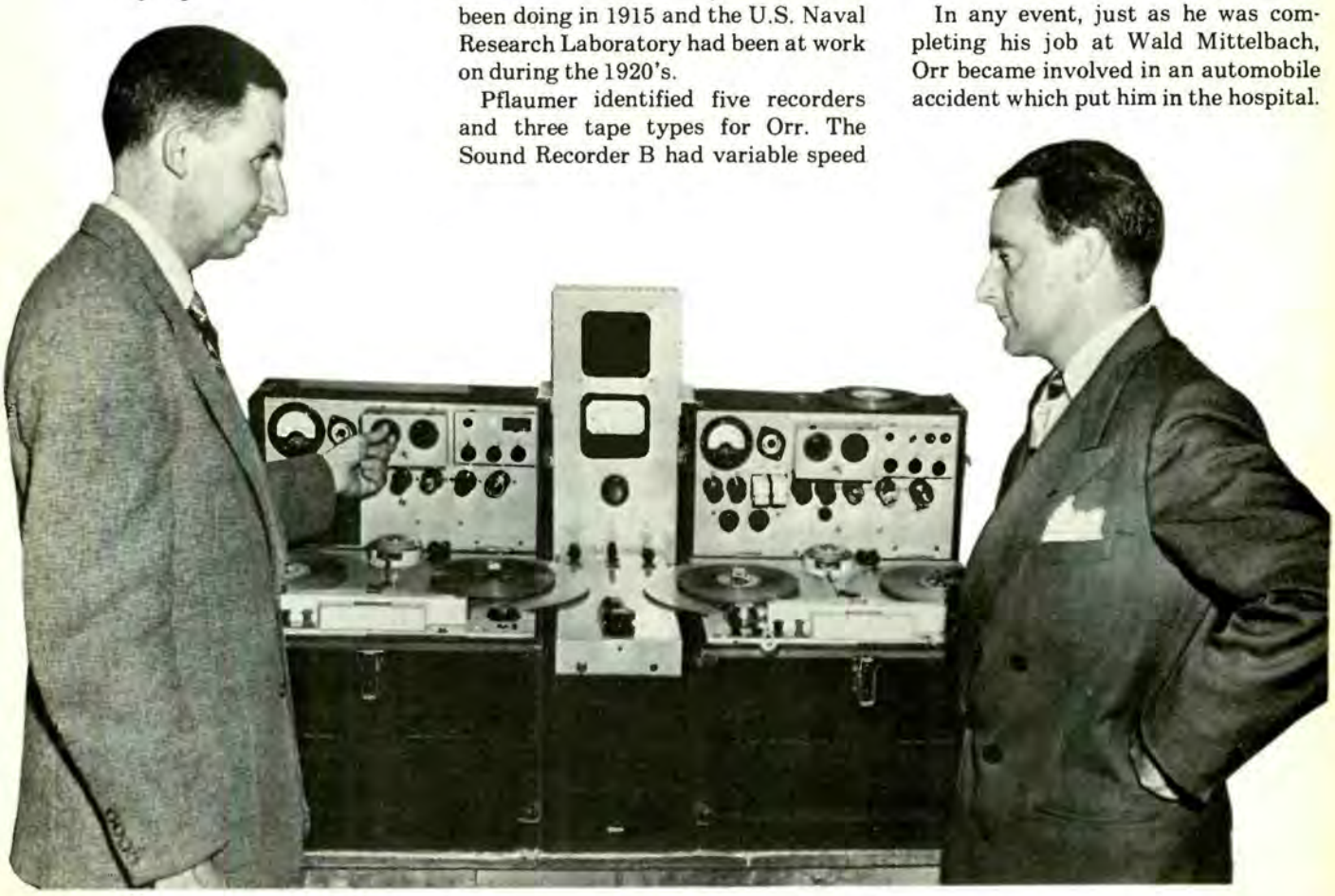
up two functioning Magnetophons, scrounged from Radio Frankfurt, Radio Munich and several other sources. Meanwhile, he also scrounged two units for his own use. These he disassembled carefully, crated, and mailed home to himself. "They had to be broken down into units small enough to fit in mail bags, or you couldn't send them," he recollects. "My biggest problem was getting the case into a mail bag, because the case had to enclose everything else. I made little wooden boxes for each of the motors and sent them separately." Altogether, there were 35 packages including tape, and fortunately all 35 arrived home safely.

In the months which followed, Mullin singlehandedly did what the president of Telefunken was unable to do—interest an American manufacturer in the Magnetophon. Telefunken's Dr. Heyne, trying to rebuild his war-torn company, took a Magnetophon to General Electric. That company called in a group of experts who took one look at it and told GE that the machine had no future, that it was impractical. Mullin was hampered because the only tape he had were the 50 reels he had shipped home to himself. At the time, nobody in the United States was making recording tape.

Unbeknownst to Mullin, another Signal Corpsman, Major John Herbert Orr, was doing something about that. Orr had been assigned the job of getting BASF's tape manufacturing plant at Wald Mittelbach back on its feet as quickly as possible. The plant had been established during the war in a rural area well away from Ludwigshafen, in order to avoid Allied bombing. Orr worked with Dr. Karl Pflaumer, a chemist in charge of the plant. Dr. Pflaumer told him that while the plant had kept on producing tape all during the war at a rate of some 3000 reels a month, the company really had no idea what the tape was being used for. AEG, he said, had been commissioned secretly to develop all sorts of specialized recording equipment, including broadcast playback sets, field dictation units and others. According to Pflaumer, the Germans visualized recordings transmitted by phone or radio at eight times recording speed to permit rapid, accurate communication—the same thing the shortwave station at Sayville, L.I. had been doing in 1915 and the U.S. Naval Research Laboratory had been at work on during the 1920's.

Pflaumer identified five recorders and three tape types for Orr. The Sound Recorder B had variable speed tape drive, and was produced for the Wehrmacht. At its slowest speed, it recorded for 70 minutes. The playback head rotated, permitting a recording to be made at one speed, then played back at a different speed without changing the pitch of the recorded signal. The fidelity was low. This was the machine Mullin kept finding all over western Europe. The Sound Recorder C was a portable knapsack model with spring motor drive for use by the Wehrmacht and radio correspondents. The Sound Recorder D was a combination recorder and transmitter for military and radio use. The RE-3, designed for the navy, was also used in broadcast work. Finally, there was the K-7, the machine Mullin found at Radio Frankfurt. Pflaumer said that there was an experimental AEG machine in addition which used a scanning-type head on an 8½-inch by 11-inch sheet of plastic impregnated with oxide. This, he said, could record up to eight hours at a time. No such machines were reported found. The three tapes were type C, dual layers of acetate; type L, a single layer of polyvinyl chloride; and LG, a dual-layered calender tape.

In any event, just as he was completing his job at Wald Mittelbach, Orr became involved in an automobile accident which put him in the hospital.



John T. Mullin (left) and Murdo McKenzie (right) flanking the two revolutionary German Magnetophons.

According to him, while there, he had an Irish nurse who helped him pass the time. In appreciation, he later named his company after her (it should be noted that Major Orr was an excellent storyteller, and at various times he has given other accounts of how he chose the name "Irish" for his tape).

Irish Paves the Way

When Orr finally was discharged from the hospital and reassigned home, Dr. Pflaumer gave him a going-away present—a brown paper bag. In it was what appeared to be iron rust. It proved to be the iron oxide formulation BASF had been using to make its tape. Orr returned to his home town of Opelika, Ala., itching to go into business for himself. Before the war, he had operated a small radio shop, and had a passionate interest in radio and electronics which had led to his Signal Corps commission. On his way home, Orr met Col. Richard Ranger, yet another Signal Corps officer, who said that he was thinking of copying one of those German machines and going into the tape recorder business.

When Orr got back to Opelika, he found an abandoned prisoner-of-war camp on the outskirts of town. He took a long-term lease, hired a research chemist, Herbert Hard, and moved in to make tape. There was no market in sight when they started—a fortunate fact, because it took Irish five years to lick the problem of putting oxide on a plastic backing so that it would stay. The process borrowed heavily from BASF's idea of calendering—using one layer of tape oxide to polish another—and Irish became the first to market a calendered recording tape.

While there's no gainsaying the importance of Mullin's and Orr's contributions to the development of tape recording, it would be an oversimplification to imply that nothing else had been happening. In fact, under the auspices of the U.S. Navy and others, there had been a fair amount of research under way since the early months of the war.

At about the same time, Armour Research Foundation in Chicago began manufacturing wire recorders for the army and navy. The recorders were the result of experimental work conducted by Marvin Camras, a recent graduate of Illinois Institute of Technology. It was in 1941, also, that Camras applied for a patent for a process of AC biasing of recordings, the technique used today in all professional and home recorders. In the months which followed, Webcor and General Electric began making wire recorders, using the Camras patents. In 1944, partly in response to a letter from Brush, Dr. Ralph Oace of Minnesota Mining & Manufacturing Co. began experimenting with recording oxides and processes for coating tape. By the end of the War, Armour had produced some 10,000 military wire recorders, and Brush had produced an additional 2,000.

With the coming of peace, it appeared that magnetic recording might yet be a reality for the amateur—but that he'd be using wire. Acting on this premise, Armour licensed Webster-Chicago, Sears-Roebuck, RCA and others to manufacture wire recorders for home use under its patents. In 1946, four young men from Armour Research decided to go into the wire recorder business for themselves. Their company, Magnecord, would produce high fidelity wire recorders for professional broadcast use. The first year, they sold ten Model SD-1 recorders, for $1500 each. The first was purchased by Glenn Martin Aircraft Co., which used it for telemetering rather than sound recording.

Although the wire recorder continued to sell well into 1948, its days were numbered. Wire simply didn't have the fidelity even of the phonograph record. It was very difficult to edit, and if the wire slipped off the spools, it became hopelessly tangled. Brands like Polyphonic, Pierce, Pentron, Brush, Silvertone, Dynaport, Crescent and WiRecorder were doomed to disappear almost as fast as they had appeared in the first place. By the end of 1948, they simply weren't selling. What was selling was tape recorders—from Ampex, Berlant, Crestwood, Brush Soundmirror, Ekotape and others.

A Momentous Event

But we're getting ahead of our story. It's May 16, 1946, and something momentous is about to happen. Bear in mind that the wire recorder boom is already on, with stores like Sears promoting them for home use. Remember that 3M has been working on producing magnetic tape for 2½ years, and Brush and Indiana Steel Company both are at work on similar projects. There's a meeting of the San Francisco chapter of the Institute of Radio Engineers scheduled for tonight at the studios of KFRC. The speaker: Jack Mullin. His subject: the two German tape recorders he's been using to do studio sound recording work for more than a year.

"The studio was really packed that



Ched Smiley (center) checking an early stereo master tape.

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night," Mullin said recently. "There was a lot of interest in the subject. We prepared some tapes of orchestra, vocalists and pipe organ. I was still using the German tape I'd brought back, and the whole thing was very effective."

In the audience that night were Harold Lindsay and Myron Stolaroff, representing a small company called Ampex. After the demonstration, the two asked Mullin about the small German loudspeaker he had used as part of his demonstration. Ampex, they explained, had been making aircraft motors during the war, and the company was now looking for a peacetime product. The engineers who made up company management (there was a total of six people on the payroll at the time) leaned toward something in high fidelity, and the German speaker might be just the thing.

Lindsay reported to Ampex president Alexander Poniatoff, who quickly decided that it was the recorder, not the speaker, which was worth pursuing. But before committing himself, Poniatoff submitted the idea to a group of technical experts. "After careful analysis, listening to the machine, examining its construction," Poniatoff reported later, "they came to the unanimous conclusion that the product had no future whatsoever. Nobody would bother to thread tape through a very complicated system. Breakage of the tape would immediately discourage anybody from using it. A disc is so much simpler and better, they said." Nevertheless, Poniatoff had a gut feeling that tape had a tremendous future. So he disregarded the advice and started work on the first professional American-made tape recorder.

Mullin, however, had given a verbal commitment to Col. Richard Ranger, whom he'd met on his way home from Europe. Col. Ranger, based in New Jersey, had announced plans to build tape recorders also based on the Magnetophon, and had gone to Germany to get parts and to meet with officials of AEG. He was to write, "The center of Magnetophon production was the AEG in the part of Berlin which finally came under the French. I found that there were parts for 18 machines available which had not been assembled. The French agreed to let them be assembled, and the 18 were to be apportioned—six to the French, six to the British and six to the U.S. When I came back some weeks later, I found the first had gone to the French, the second to the British and the third was to go to the French. Well, we finally got that straightened out and five of ours did excellent service in our Army Broadcasting and the sixth one I brought back to Fort Monmouth along with some 20 cases of all kinds of technical equipment which would be of interest to the Signal Corps."

Meanwhile, word of the successful IRE meeting had found its way to Frank Healy of Bing Crosby Enterprises. Accordingly, Mullin was invited in June, 1947 to demonstrate his machine for Crosby and his technical director, Murdo McKenzie. "After the demonstration there was a lot of interest, but I didn't get the job. Instead, I was invited back in August to record the first show of the 1947-48 season, to see how it would go," Mullen recalls. "At the same time, they were recording the show on discs.

Anatomy of a ¼" tape recorder

Automatic shut-off

Hysteresis three-motor drive

Electro-magnetic braking prevents tape spillage

Rugged

Neoprene head mount for good alignment

Heavy, 3/16" plate for good alignment

Pressure *brush* improves contact

Plug-in electronics



10" NAB reels (or 5" or 7" standard)

Only seven moving parts

One-piece, 4½ pound flywheel-and-capstan

Computer logic permits any command sequence

Remotable

Remote record for no-thump recording

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They also invited Col. Ranger to bring two of his machines out at the same time. He showed up with his first two. He had rushed them through to get them there in time for the demonstration. So he recorded on his, I recorded on the Magnetophons and the Crosby people recorded on discs. During the playback, there was a comparison, and the Crosby people made an immediate decision that they didn't want to hear any more of Ranger's. That was unfortunate because he hadn't had the time to get the bugs out of his."

Bing Crosby on Tape

At the time, the Crosby show was the only major network program which wasn't broadcast "live." Crosby had been off the air entirely in 1945, and had returned to work in 1946 only because the fledgling American Broadcasting Corporation had promised that he could record his show in advance. In 1946, that meant 16-inch transcriptions, revolving at 33⅓ rpm. Crosby, being a casual person, liked to do the show without worrying about timing or fluffs, then leave the job of trimming it down to size to somebody else later. That meant rerecording from one transcription to another, with a resulting loss in sound quality on each transfer. Since some transfers were made three or four times, the final version sometimes didn't sound so good. The sound in some cases was so poor that the sponsor blamed it for a fall-off in ratings. Crosby was warned that if he didn't do something about the poor quality of some of his shows, he'd have to go back to doing the program "live" or risk the loss of his sponsor.

"Well," Mullin continues, "the result of the demonstration was that the Crosby people wanted me to stay right there and go through an editing process, to make a broadcast out of it. I did, and they saw how easy it was with tape. The next thing I knew, I had a job recording the Bing Crosby show for the rest of the season."

Mullin was still using his original German recorders and 50 rolls of recording tape; it wasn't until April 1948 that Ampex delivered its first two recorders to Crosby, and Scotch tape didn't show up until Mullin was ready to record Program #27. "In the meantime, all I had was my original 50 rolls. I didn't dare throw anything away when I edited, because I didn't know where I could get any more. So after every show, I'd go through and take the tape apart, splicing all the little bits together so that I could use them over again."



Project engineer Harold Lindsay and the Ampex 200's which were closely modeled after Mullin's Magnetophons.

Crosby was so taken with the Magnetophons and later with the Ampexes that he became the West Coast distributor for Ampex professional products. He was instrumental in getting ABC to purchase the first 12 machines produced by Ampex.

"Once Ranger was out of the picture, I was free to accept Ampex's invitation to work with them," Mullin continues. "They borrowed my two machines, measured them, examined the parts and the construction, then produced the Model 200. It's not an exact copy, but it's very much like the German machines."

Magnetic Tape Experiments

At 3M, a management decision had been made the previous year to go ahead on the tape recording project, even though Mullin's machine had yet to make an appearance. The first problem was getting the oxide to stick to the tape backing. The company disposed of that one quickly, but decided that something could be done to improve the oxide coating which Brush was supplying for use with its machines.

Since machines were necessary to the sale of any magnetic tape, 3M began contacting firms which were working on machines and submitting samples of experimental tape to them. It was during this process that 3M found out what Mullin and Ampex were up to. The company had already decided that standardization of tape widths, speeds and reel sizes was essential if tape recording were ever to develop full scale. Since the Magnetophon's speed and tape size seemed satisfactory, 3M simply standardized around them. Unfortunately, the company's problems weren't over. It discovered that the red iron oxide that it had developed so laboriously was already covered by a patent held by Marvin Camras. 3M promptly sought an exclusive license, then tried to use it to discourage other manufacturers from entering the field.

Orr observed that his technology derived from German technology, for which patent rights were available to anybody through the U.S. Alien Property Office. But other early tape makers—Audio Devices and Reeves Soundcraft—found themselves in a round of legal battles to prove that they weren't infringing upon the Camras patent.

While Magnecord's decision to switch from wire recorders to tape in 1948 lacked the impact of the appearance of the Mullin machines, it sealed the doom of wire. John Boyers, one of the original partners, recalls how it came about: "Going into the tape recorder business on a professional basis was rather difficult since we had an investment in a wire recorder which promised to be a very good machine. But our New York representative convinced one of the other partners and me at two o'clock

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one morning that we should make a tape recorder. By the time we got back to Chicago a day and a half later, we had outlined the genesis of the Magnecord PT-6. Two months later, we showed our first unit to the National Association of Broadcasters' convention."

Within weeks, no respectable broadcast or recording studio would be caught dead without either an Ampex 200 or Magnecord PT-6—or both—on the premises. The tape boom was on. As professional users switched to tape, dozens of home recorders began to appear—carrying names like Stenovox, Crestwood, Stancil-Hoffman and others.

The Dawn of Stereo

Then, one day in 1949, David Apps of General Motors Laboratories approached Magnecord with an unusual request. Could the company build a tape recorder which could record stereophonically? GM had been using a PT-6 to analyze automobile noise, but had found it unsatisfactory because of the limited perspective. Perhaps a stereo model might solve the problem. Magnecord responded with a PT-6 modified so that there were two three-head assemblies spaced $1\frac{9}{16}$ inches apart. The upper assembly recorded the left channel, the lower assembly the right. Having made one stereo machine, Magnecord made two more, for display at the 1949 Audio Fair in New York. The response was little short of fantastic. Immediately following the Fair, Magnecord built 12 machines to fill orders it had already received, then another 25 which were sold by the time they were assembled. After that the company sold hundreds.

Two early customers were Ched Smiley, of Livingston, N.J. and Emory Cook of Stamford, Conn. Both had experience as recording engineers, both were electronic experimenters and audio hobbyists. Cook used his to record trains, a thunderstorm, the sound of surf and eventually music in Boston, while Smiley took his to the May Festival in Florence, Italy in 1951 to record a symphony orchestra for commercial release on tape.

The musical applications of Magnecord's new machine were obvious to the company's founders, so in 1950, they hired a musical coordinator, a young recording engineer and audiophile named Bert Whyte. Whyte's first chore was to use the stereo machine to record as many different types of music as possible. As the Benny Goodman, Lionel Hampton, Woody Herman, Jimmy McPartland and other bands passed through Chicago, Whyte taped them all in stereo. Unfortunately, none of these tapes (many still in existence) has been released commercially, thanks in part to union problems.

It was Whyte, in fact, who had the chore of explaining stereo to James Caesar Petrillo, then president of the American Federation of Musicians. Since Petrillo had brought all commercial recording to a screeching halt in the United States only a few years before, he was a man feared by record companies and broadcast executives, and adored by his union's members. "I had been down to the University of Illinois at Urbana," Whyte said recently. "Leopold Stokowski was doing a concert there, and he had agreed to let me record it on an experimental basis. I came back to Chicago with the tape, and arranged for an appointment to play it for Mr. Petrillo. He sat there and listened, and as he listened I could see his face clouding up. When the tape ended, he scowled and said to me, 'Of course, you realize that we'll have to work out a new pay scale for stereophonic recordings. Since there are two channels on the tape, I'd consider that two recording sessions. Each man in the group would have to be paid twice.' "



AFM president James Petrillo, welcoming the advent of stereo with a benign smile.

Since stereo hadn't gotten to the point where anybody was considering recording it commercially, it was obvious to Whyte that any such suggestion would kill stereo before it ever got started. "Yes, Mr. Petrillo," he explained. "But don't you see? If stereo catches on, everything will have to be rerecorded since there are no stereo recordings now." As Petrillo contemplated what this would mean in work schedules for his musicians, the scowl slowly faded, to be replaced with a benign smile. "Yeah," he said, and the meeting was over.



(Left to right) Bert Whyte and Leopold Stokowski: A toast to the beneficence of AFM's Petrillo.

NEXT ISSUE:
The Stereo Era

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THE HISTORY OF RECORDING

By Robert Angus

PART 6: The Stereo Years—1950-1976

By the time stereo came to the tape recorder, much of the fun and adventure had gone out of the business. As the tape recorder became broadly accepted, first by professional users in broadcast and recording studios, and much more slowly by the public at large, it became more an instrument from which money was to be made, and less an object of glamour, mystery or wonderment. The story which follows, then, is largely one of men making money and of an instrument evolving from the recording studio to the teenager's bedroom.

The year was 1950, and the stereo tape recorder had only just become available. Developed by Magnecord the year before as a result of a request from General Motors for a twin-track tape recorder which would enable the company's engineers to analyze auto noise, it was being used by a company employee, Bert Whyte, to record music stereophonically. Whyte recorded such groups as the U.S. Navy Band, Lionel Hampton, Leopold Stokowski and Benny Goodman for Magnecord, merely to prove that stereo recording was both feasible and aesthetically pleasing.



Stereo pioneer Emory Cook and his Magnecorder.

His efforts weren't lost on two Easterners. In Stamford, Conn. and Livingston, N.J. lived two young men with parallel interest in audio and stereophonics. They were, respectively, Emory Cook, who would shortly become the major supplier of high fidelity demonstration discs during audio's early years, and Ched Smiley, who would become the first man to produce stereo tapes for sale to the public. Before that, however, he and Cook would develop the binaural record and a system for playing it back.

The first step for both men was to acquire one of the stereo Magnecords. Cook packed his off to the New York Central's railyards at Harmon, N.Y., to the seashore, to Mexico, to wherever there were dramatic and unusual sounds. In 1951, Smiley took his to Florence, Italy, where the May Festival was under way. There he recorded nearly three hours worth of symphonic favorites with the Florence May Festival Orchestra.

The Cook binaural record, for which these recordings were destined, consisted of two bands on the record—an outer band representing the left channel; an inner band for the right. To play it back, Smiley's Livingston Audio Products Corp. developed a Y-shaped arm with two cartridges. Theoretically, when the arm dropped onto one of Cook's records, the two channels would be synchronized. But the synchronization was practically never perfect because it was well-nigh impossible to insure that the dual styli would drop exactly into matching grooves. So Smiley abandoned records and turned his attention to producing stereo recordings on tape.

Rush on Mono Recorders

Meanwhile, tape enthusiasts, blissfully unaware of the behind-the-scenes stereo activity, rushed out to buy monaural recorders made by Wilcox-Gay, Crestwood, Bell Sound Systems, Revere, Webcor and others. Recording Associates beat Smiley to the punch by issuing the very first commercially-recorded tapes—eight half-hour programs of organ music. However, these weren't stereo recordings. Nor were the Magnecordings by Vox, assembled by Whyte for Magnecord from monaural European recordings made by George Mendelssohn of Vox Productions. To the hopeful sales managers of Scotch, Ampex, Berlant-Concertone and Magnecord, it looked as if the popularly-priced monaural tape recorder might do in the home what the professional recorders of Ampex and Magnecord were doing in broadcast and recording studios—eliminate the disc altogether.

Alas, it was not to be. Tape recorders were edging downward toward the $100 level. And while those first recorded tapes cost $8.95, you could buy records for about half that price featuring big-name orchestras, bands and soloists which contained 50 percent more music.

What made the difference was Smiley's stereo tapes, finally released in 1954 when he felt there were enough players available to make the project commercially feasible. In addition to the Magnecords, Smiley developed

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and manufactured his own low-cost stereo tape deck and stereo amplifier. Suddenly RCA sat up and took notice. So did Mercury Records, a Chicago-based label for whom Whyte by now was working. Both RCA and Mercury began making stereo recordings of their major symphonic recording sessions—the latter with Whyte in charge. RCA's initial blockbuster, Strauss' *Also Sprach Zarathustra*, recorded by Fritz Reiner and the Chicago Symphony [still available on Victrola VICS-1265], added impetus to the stereo recorded-tape movement, and by 1957, half a dozen classical record labels and several pop labels were producing their own stereo tapes or leasing masters to independent producers like Smiley. Then something happened.

The Stereo Record

What happened was that Decca Records in England and Westrex, a subsidiary of Western Electric in the United States, had found a way of doing what Smiley and Cook could not—putting both stereo channels into a single record groove. At about the same time, RCA started talking about a tape cartridge it would shortly introduce—a cartridge which could be changed automatically like a record, which contained the tape so that no threading would be necessary or tape spill possible. Best of all, the new cartridge would cost about the same as a phonograph record, thus eliminating the need for open-reel tape. It took RCA more than a year to get its product onto the market. But in that time, sales of recorded open-reel tape plummeted from about $2.4 million in fiscal 1957 to less than $100,000 the following year.

When the RCA cartridge eventually did appear, the price was about midway between that of a stereo record and an open-reel tape. The cartridge actually was the forerunner of today's cassette, containing two hubs, quarter-inch tape and an overall size larger than that of a paperback novel. The worst thing about the system, however, was that RCA seemed to be incapable of making a changer that worked. The tape jammed or sounded bad. By the time RCA, Mercury Records, Bell Sound and a few other manufacturers gave it up as a bad job in 1963, open-reel tape was making a comeback.

That was due primarily to some forthright action by Ampex early in 1959. Not only had the 1958 slump hurt the sale of music on tape, it had been equally devastating to recorder manufacturers. As one of the largest and best-financed, Ampex decided to do something about it. What Ampex did was to create the quarter-track format—two pairs of stereo tracks where once there had been one on conventional quarter-inch tape. First the company made the machines, urging every other recorder manufacturer to do the same. Then it created a subsidiary to release music on tape—not the organ musings of Hack Swain, or Lenny Herman's Mightiest Little Band in the Land, but the biggest names it could find. To get them, Ampex went first to London Records, English Decca's American subsidiary. It locked up tape rights to the mammoth London classical and pop catalogues, then went on to sign up as many smaller labels as it could. To head the operation, Ampex hired Edward R. Wallerstein, a former chief executive at RCA Victor, and president of Columbia Records at the time that company introduced the long-playing record.

Early Videotape Experiments

Before we leave the 1950's, there's one more important development to examine. In November, 1951, Bing Crosby Enterprises demonstrated the first videotape recorder. Produced by Ampex, it went into network use some 2½ years later on CBS's evening newscast with Douglas Edwards. Just as audio tape had, in seven years, eliminated the practice of repeating programs "live" for the different time zones, videotape almost overnight swept the television industry, making delayed programming possible. Even before the Edwards tape was aired (in black and white, of course), RCA was announcing plans for home videotapes in color. The year was 1953, and by that time, Bing Crosby Enterprises was already demonstrating an Ampex color videocorder, designed for professional use.

The RCA cartridge, while it may not have worked, managed to disrupt the tape market for nearly three years. Before it vanished from the scene, there was yet another attempt at tape automation. This one had auspicious sponsors. It was the brainchild of Marvin Camras, the man who had done so much pioneering work on wire recording in the early days of World War II, and the man who held the basic patent on red iron oxide formulation. The tape cartridges—three-inch squares of plastic containing a single hub with the tape anchored firmly at the end and a heavy polyester leader which the player mechanism could grab, to pull the tape out of the shell—would be made by Minnesota Mining. A 3M subsidiary, Revere-Wollensak, would make



The historic first broadcast via tape was CBS' Nov. 30, 1956 airing of "Douglas Edwards and the News" from New York City.

the cartridge changers, and Columbia Records would provide the music. Bell Sound Systems and its recorded music subsidiary, Bel Canto Tapes, still involved with RCA's unit, rushed to provide tapes and hardware to accommodate the new system. Unfortunately, the 3M and Bell changers suffered the same problems as the RCA units. They were highly successful at pulling the tape out of the shells, not nearly so efficient at getting it back in again. The changers jammed, and the entire system collapsed.

During the summer of 1964, the open-reel tape business was humming along nicely, thanks in no small part to Ampex's aggressive merchandising of recorded music. With the RCA and 3M disasters fresh in mind, it hardly seemed the most opportune time to launch a new tape system. Nevertheless, that's exactly what Philips of the Netherlands did—not as a music playback system, but as a lightweight portable dictating system.

The Norelco 150 Carry-Corder didn't look like the kind of machine that could revolutionize anything. Sure, it was compact, small enough to fit in an overcoat pocket. At 2¾ pounds it was lighter than any conventional recorder. But the sound simply wasn't good enough for music reproduction, and the initial price—$149.50—put it in the class with some AC stereo decks. For more than a year, it seemed that officials at Philips and Norelco didn't realize what they had in the Carry-Corder and the Compact Cassettes it used. These tiny plastic wafers looked like miniature versions of the ill-fated RCA cartridge. Yet, despite their size and the slow speed with which the tape moved—1⅞ inches per second—they worked. And, if you weren't too critical, you could even record and play back music on them with not-too-disappointing results.

Automotive Tape Players

Still, to the people who invented it, the Carry-Corder seemed to be nothing more than a high-priced dictating machine or electronic toy. But something was to happen which would make them change their minds. What happened was that a West Coast marketing genius named Earl Muntz had run across a 1954 invention by George Eash, and decided to build a business.

Sporadically during the postwar years, manufacturers of record-playing equipment and automobiles flirted with the idea of putting record players into automobiles. The problems were many. How could you keep the tone-arm in the record groove on a bumpy road? Unless the records were of a special type, how could you make a player small enough to fit into the dashboard of a car? Even if you achieved these goals, how could you make records which would last more than a couple of playings?

Eash, a garage tinkerer, was working for a man who said he'd like to have a music system in his car. Instead of monkeying around with records, Eash concentrated on tape, coming up with a compact (by 1954 standards) player which utilized an endless loop cartridge that didn't have to be threaded or turned over. The tape unwound from the center of the tape pack, fed across an open face which permitted contact with the player head, and rewound on the outside of the tape pack. Eash patented it. Some six years later, he mentioned it to his friend Earl Muntz. Muntz had built a fortune in the early postwar years in used cars. One of the first used car dealers to use television to advertise, he became known throughout southern California as Madman Muntz. Then, in 1950, he decided that the television business looked even better than used cars, and began making Muntz television sets. Several years later he sold out, profitably.

When Muntz saw what Eash had been working on, he saw new business vistas opening before him. Before long, Muntz was manufacturing car tape players based on Eash's invention, modified to utilize the four-track standard developed by Ampex. The public didn't actually become aware of the four-track cartridge until just about the time the cassette made its appearance. In 1964, however, Muntz not only was selling players and building a library of music to go along with them, but setting up his own Muntz car stereo centers to sell and install the equipment.

Business, in fact, was so good for Muntz that all sorts of people were hopping on the bandwagon. One of those who heard it rolling by was Bill Lear, an inventor and electronics executive best known for building the Lear Jet executive airplane. Just how Lear's Stereo 8 cartridge (containing eight tracks instead of Muntz's four, but similar in external size and shape) came into existence isn't entirely clear. Muntz has said that it was a blatant attempt to get around the Eash patents, and Bill Lear hasn't effectively denied that. In any event, by 1965, Lear had a product good enough to interest the executives at RCA, Motorola and the Ford Motor Company. A plan was announced whereby RCA would provide music exclusively for the new system, Ford would sell cars with eight-track players built into them (and would urge its dealers to sell players for older cars), and Motorola would make the players. With the advantage of a heavy advertising barrage, plus RCA's leverage in the record



Earl "Madman" Muntz (left), legendary supersalesman and pioneer of car stereo tape equipment, oversees installation of a new system.

business, eight-track overshadowed Muntz's cartridge and the lowly cassette almost from the start. After all, in 1965, there was no such thing as a stereo cassette.

One man who was upset by all of this was Wybo Semmelink of North American Philips. Semmelink was in charge of selling the 150 Carry-Corder and the blank cassettes which went with it. A tape and audio fan from 'way back, Semmelink was convinced that the cassette could do a much better job of reproducing music—and doing it in the car—than either of the cartridges. It took him a year of heated arguing with the powers that be at Philips in Holland to convince them. In 1966, Norelco introduced an assortment of cassette products which included not only a stereo deck for the home and a car conversion kit for the Carry-Corder, but a cassette changer system and a car tape player. But Semmelink went further. He persuaded Ampex, which was already making music for both the Muntz and Stereo 8 systems in addition to its open-reel tapes, to produce recorded cassettes as well. A three-way race was on.

The cassette quickly became a home music and portable music playback system. As improvements tumbled one on top of another, the cassette made short work of the less expensive open-reel recorders, while eight-track chased the Muntz cartridge off the scene in about three years. By 1976, the cassette had eliminated the open-reel portable recorder (with the exception of a few professional units), and had made open-reel home stereo recorders priced under $400 virtually obsolete.

Dolby Noise Reduction

Perhaps no development played a greater part in the cassette's success than the development of a low-cost noise-reduction circuit which could be built into the recorders. Because of the slow tape speed and ultra-narrow tape tracks, noise had been a problem with the cassette from the beginning.

The man who supplied the idea was Ray Dolby, an electronics engineer who had worked for Ampex during his high school vacations, then won scholarships to Stanford University and Cambridge. Dolby was a music lover who was intrigued by the problem of noise which seemed to be inherent in tape recording. During a stay in India with the Peace Corps, he hit on the idea of breaking up the frequency spectrum during recording so that certain frequencies and certain levels of signals are recorded at higher levels than others. Then, during playback, these signals are suppressed by exactly the same amount, at the same time suppressing any background noise or hiss.

By November 1965, he had built a full-frequency unit, designed for professional recording work. Decca Records was so impressed by his demonstration that they bought every unit he could produce during the next five months. Within a year of delivery of his first working machine to Decca, the Dolby A noise reduction unit had become a fixture at broadcasting and recording studios in Britain.



Wybo Semmelink and the first Philips cassette players. (Inset) 3M's early stereo cartridge player.

The following year, Dolby received a phone call in his London office from Henry Kloss, then president of KLH. Kloss wanted to know why it wouldn't be possible to manufacture a low-cost version of Dolby A suitable for building into a home recording tape deck like the one being marketed by KLH. By late summer 1968, Dolby did just that, enabling Kloss to market the first two home recorders with Dolby B noise reduction. Both were open-reel recorders.

During this period, Dolby took a good look both at cassettes and cartridges with an eye toward incorporating his noise-reduction system. He was unimpressed with what he saw and heard. Nevertheless, during a visit to the United States, he told the Audio Engineering Society that there was no reason why a Dolby B integrated circuit chip mightn't be developed which could be incorporated into a cassette recorder.

One of the people who heard him was Richard Ekstract, publisher of the trade newspaper *Audio Times*. Ekstract mentioned Dolby's comment to his friend Walter Goodman, then chief executive officer of Harman-Kardon. As it happened, H-K had just come out with a cassette deck which was drawing rave reviews from audio critics. But the company was all too aware of its shortcomings and was looking for a way of upgrading the new model which was already on the drawing boards. Dolby noise reduction seemed like a heaven-sent answer.

Meanwhile, Dolby had taken a Wollensack 4700 cassette deck back to England with him. For the first time he saw a cassette unit with what he considered high fidelity possibilities, and started to work on the necessary IC. And at just about the same time, Henry Kloss, having left KLH, was setting up a new company, Advent, to market a television projection system he'd been working on.

In order to pay the bills, Kloss needed a product to sell right away. The product he chose was a cassette recorder, and to increase its high fidelity capabilities, Kloss fell back on his

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idea of Dolby noise reduction, not knowing that H-K and perhaps other manufacturers were thinking along the same lines. Kloss's idea this time was that the cassette had the potential to emerge not only as the ultimate home music system by combining all of the technical ingredients available, but might even be the ideal picture-and-sound medium. So he designed a deck which featured the best mechanical tape transport he could get, Dolby noise reduction and the ability to handle chromium dioxide, then being touted as the ultimate tape for both audio and video. Kloss moved to become the first manufacturer to offer not only a deck capable of using chrome tape, but the tape itself. Further, he planned to offer recorded chromium-dioxide cassettes, to complete the music system. The latter were not to appear for another three or four years, due to difficulties in getting really good tape masters, the proper duplicating equipment, and ironing out all the bugs.

Those first Dolbyized cassette decks were instantly successful. By the early 1970's, you simply couldn't sell a cassette deck priced above $300 if it didn't include Dolby. Several Japanese manufacturers who tried to buck Dolby with their own noise-reduction systems found it very difficult, indeed.

Developments in Japan

Until the late 1950's, virtually all of the tape recorders sold in the United States were made either domestically or in Europe. But with the coming of stereo in 1958, Japanese manufacturers began to show an interest. The first attempts were low-cost, low-fi battery portables. But in 1957, a Hollywood executive named Joseph Tushinsky was in Tokyo on business. As a result of his activities, he found himself with some extra yen which would be very difficult to convert to dollars when he got home.

"So," he recalls today, "since I had all that money, I went around looking for things to buy." In this pursuit, he traveled to the Shinagawa section of the city to visit a small new company named Sony. "There were only a handful of employees, and they were working on a dirt floor inside a converted quonset hut. They took me into a corner of the hut where there were some wooden tables and a couple of signs. On one of the tables was a tape recorder. Now, I was interested in tape



Ray Dolby, whose noise reduction inventions played perhaps the greatest part in the cassette's success.

recorders, so I asked about it. They told me they'd just developed it. They claimed it was the first stereo tape recorder anywhere in the world with built-in power amplifiers.

"So I asked how many they had. They told me there were seven. I asked how much each one would cost. I think they replied a hundred dollars each. 'Okay,' I said, dipping into my pocketful of yen, 'I'll take all seven.' They looked shocked and asked why I wanted them all. I replied that I wanted to take them back to the United States to see whether there was a market for them. If so, I explained, I might be interested in distributing them in the U.S. The real reason was to keep anybody else from seeing them before I'd finalized a deal."

Tushinsky's Superscope Inc. became Sony's distributor in the U.S. in 1958, the first company to offer a high fidelity recorder from Japan. Another man responsible for the Japanese invasion was Robert Metzner, who had been buying motors from Akai Electric Company for his Metzner Starlight turntable. At the time (roughly 1960), the Ampex 601 was the envy of every amateur recordist who couldn't afford one. When the officials at Akai saw it, the idea of producing a copy which would look suspiciously like the 601, would record and play back stereophonically and which would sell for a fraction of Ampex's price seemed almost irresistible. The next thing Metzner knew, he was heading a company called Roberts Electronics, the American distributor for the Akai recorder. Metzner, an engineer, insisted on taking an active part in the design and engineering of the Roberts. The success of these two encouraged other manufacturers to develop and market their own tape recorders.

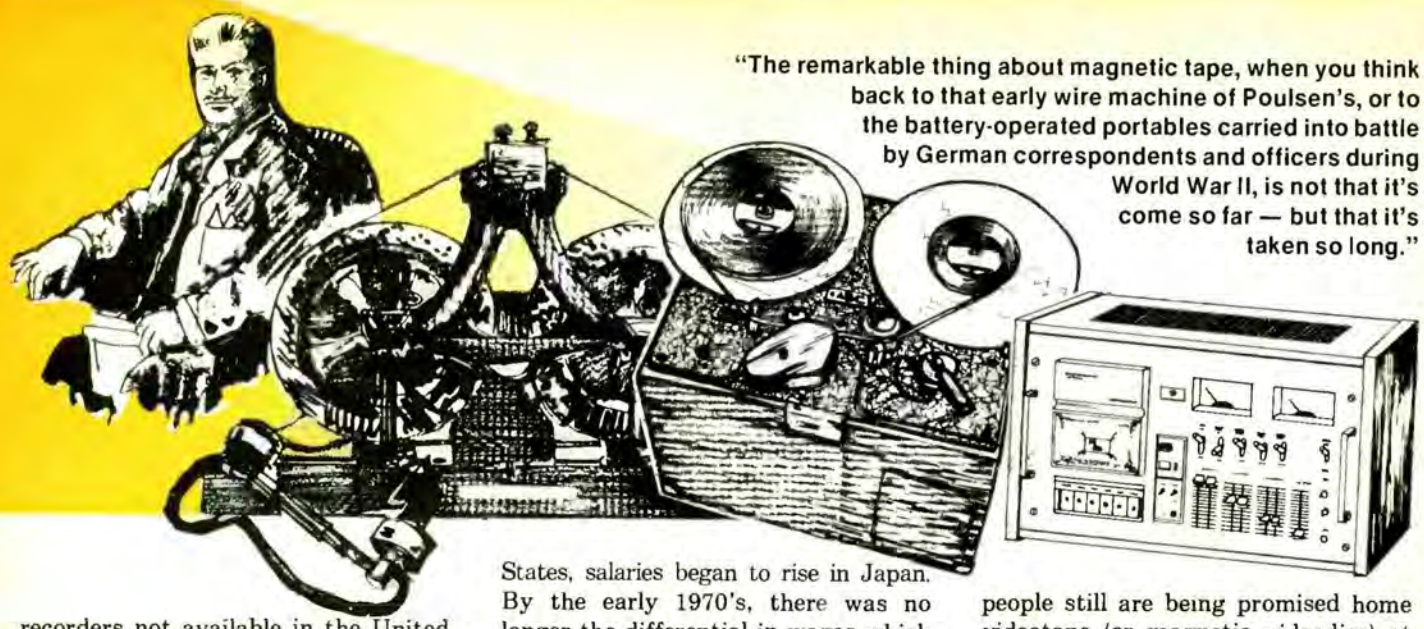
During the 1960's, the percentage of recorders made in the United States dropped from about 65 percent at the beginning of the decade to less than five percent at the end, thanks initially to lower labor costs in Japan; later to superior technology and performance.

The first Japanese tape recorders were unimpressive devices, cheap rim-drive portables which generally sold for less than $100. One, in fact, was offered by mail in 1958 for the incredibly low price of $29.95. The manufacturer, Wakataka Bussan, got its hands on the American Medical Association mailing list, and wrote doctors proposing that they become distributors in their towns for the company's tape recorder. As distributors, they could buy the machines at the distributor price of $29.95, half the price the recorders were supposed to sell for. The letters suggested that by selling the recorders, the doctors could supplement their incomes. The National Better Business Bureau regarded this idea as preposterous and suggested that all Wakataka Bussan was trying to do was to give the doctors the idea that they were getting a bargain on the recorders.

Until Sony and Roberts came along, then, Japanese tape recorders had a poor reputation in the United States. However, the success of Tushinsky and Metzner encouraged other American businessmen and Japanese manufacturers to get in on the act. One of the first was Hosho of America, a company formed in 1966 with actor William Holden as a principal, which bought recorders from the giant Matsushita Electric Company. Unfortunately, component-quality tape recorders were new to Matsushita, and the number of lemons delivered to Hosho was very high. The company changed its name to Concord, and spoke sharply to Matsushita. The percentage of lemons dropped, but they still appeared with disconcerting regularity.

Meanwhile, other Japanese companies—Mitsubishi, Hitachi, Japan Victor and others—published elaborate catalogues showing, among other things, a range of professional tape

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"The remarkable thing about magnetic tape, when you think back to that early wire machine of Poulsen's, or to the battery-operated portables carried into battle by German correspondents and officers during World War II, is not that it's come so far — but that it's taken so long."

recorders not available in the United States. These studio-type units looked better than anything available in the United States at the time, but the companies never delivered. That in turn led some Americans to suspect that the units didn't really exist.

Another suspicion was that the lemons being delivered to Concord, Roberts and others were the result of Japanese manufacturers using the brand names of others to experiment, make mistakes, and learn the tape recorder business—without tarnishing the reputations of their own brand names. That suspicion seemed to be confirmed in the mid-1960's when first Matsushita and later Akai and others introduced new tape equipment designed to compete with the recorders they were supplying to importers—and the failure rate on their own was much lower than on the American brands.

Perhaps as a result of their earlier experience, or as a result of improved technology, one Japanese manufacturer after another introduced tape recorders which not only represented value and possessed audiophile or professional features, but which performed up to specification. As they did, American manufacturers like Ampex, Concertone and others first began buying recorders from Japan, then shut down their domestic factories, and eventually got out of the tape recorder business altogether. The cassette and cartridge, introduced in the mid-1960's, accelerated the process.

What gave the Japanese a competitive edge initially was the low cost of labor in the Far East. But as Japanese-made tape recorders increased their share of sales in the United States, salaries began to rise in Japan. By the early 1970's, there was no longer the differential in wages which had existed a decade earlier—but by that time, American tape recorder manufacturing capability had all but disappeared. The result was more expensive—albeit much more reliable and much higher-fidelity—tape recorders for home and studio.

Home Videotape Recorders in the Future?

In 1964, the British Information Service startled the tape world with news that a British manufacturer, Telcan Ltd., had produced a videotape recorder which used ordinary audio tape and cost a mere $94. The black-and-white one-of-a-kind recorder made a belated appearance in New York, where it drew unfavorable notices, but it spurred Sony, Ampex, RCA, Concord and others to race for a video recorder which would be suitable for home use. By 1967, Sony was running television commercials for its $1000 black-and-white system, while Ampex actually was marketing a similar system on a limited basis. Telcan never went on sale in the United States (or anywhere else), although an importer later tried to sell a kit version manufactured in Japan for $164. That never got anywhere, either.

Whether it was their high cost, the fact that color was just becoming popular, or merely that they were ahead of their time, the Sony, Ampex, Concord, GBC and other "home" video recorders never made it. Nor did color versions introduced in the early 1970's—partly because of cost, partly because they were difficult to set up and operate, and partly because there was no recorded material to play on them. At this writing, the American people still are being promised home videotape (or magnetic videodisc) at some time in the foreseeable future.

The remarkable thing about magnetic tape, when you think back to that early wire machine of Poulsen's, or to the battery-operated portables carried into battle by German correspondents and officers during World War II, is not that it's come so far—but that it's taken so long. Charles Dexter Rood had hundreds of small stockholders in 1912 who were convinced that his recorders were superior to anything obtainable from the phonograph. During World War II, the Germans demonstrated that their tapes could fool experts into believing they were listening to "live" broadcasts. Yet it's taken until the 1970's for the average American to accept magnetic tape as a music medium equal to the gramophone record. Even now, we lag behind our British and European cousins, who spend much more of their francs or pounds or lira for recorded music on tape than we do.

The tape recorder in the studio may look like a remarkably unglamorous item. But lurking behind its brushed aluminum template is a remarkable history peopled by the likes of inventors Valdemar Poulsen and Marvin Camras; Charles Dexter Rood, the man who may have been a visionary or a scoundrel, or may simply have been senile; S.J. Begun and a Signal Corpsman named Jack Mullin; men like Bert Whyte and Ched Smiley, who had definite ideas about what the recorder could be used for; and men like Joe Tushinsky and Earl Muntz who knew how to make a buck.

End of Series

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