

IOHN MULLIN, seen soday with one of the Magnetophons which he brought to the U.S. as war souvenir.

The most unforgettable moment in my life was the one when I stood before my Magnetophone Tape recorder and pressed the "PLAYBACK" button for the first time in the presence of Bing Crosby, John Scott Trotter, and Bing's producers, Bill Morrow and Murdo McKenzie. Everything was at stake. By invitation I had been present with my colleague, Bill Palmer, to record the first radio show of the 1947-48 season in the NBC-ABC studio complex in Hollywood. And now we were to hear the result of our efforts and to be judged by perhaps the most critijudged by perhaps the most criti-cal ears in the world of radio and recording.

To be sure, this was in August, 1947, and the show would not be broadcast until Oct. 1, but the policy was to record it well in ad-

vance of release time in order to enable it to be edited down from an indeterminate running time to a neat half-hour program. This technique gave Bing the ability to be relaxed, to ad lib as he chose and never to be concerned about

timing.

The policy had been to record easually on 16-inch lacquer disks. Editing was later accomplished by re-recording from disk to disk to produce the final radio show, but the losses in tone quality had at times been excessive. Throughout the previous season, the golden ears of the producers, network executives, advertising agency representatives, and Bing himself at times underwent considerable torture when the final disk assembly was played on the air coast-to coast on the full ABC radio net-

work. The audience rating had been falling badly. Philoo, the sponsor, was unhappy and it had been pretty well decided that if it fell a few points more at the start of the new season. Bing would have to go back to live broadcasts. broadcasts.

Prior to our invitation to come down to Hollywood from San Francisco to record and possibly, just possibly, to edit our tape into a complete show, the producers had looked into every alternate means of recording sound that showed any promise of success. Mostly these boiled down to variations of disk recording methods and photographic sound-on-film and photographic sound-on-film systems. ABC had even arranged for tests to be made on a magnet-ic tape system in New York, Lt. Col. Richard Ranger's Rangerione, but the results had been completely unacceptable. None of them had shown better promise than the one they had been employing. I am sure they held out little hope for success in testing our apparatus. The Big Test

The tape came up to speed— then, Opening theme—Crosby: "Blue of the Night"

Applause Introductory Patter: Crosby and Song-Crosby: "My Heart Is a

Applause
Murdo McKenzie signaled me
to "cut." I pressed the "STOP"
button. There were surely no more
than two seconds of silence, which

seemed more like an eternity to me, and then-a shower of compli-ments. One small machine, one of a pair, side by side on a make-shift table—the only two of their kind in the United States arranged to record and reproduce magnetic tape with such remarkable fidelity. that in a listening demonstration lasting almost five minutes had up-

By JOHN T. MULLIN Manager, 3M Ca.)

set the entire future of sound recording in this country.

Why only this pair of machines, and how did they happen to be here? Let me go bock to 1943. I was in England at the time, in the U.S. Army Signal Corps, but assigned to the RAF, working as a liaison officer concerned with interchange of technical information. A problem had come up where a certain Signal Corps radio receiver was found to be highly subject to interference from a type of high powered RAF radar transmitter. We were working to reduce vulnerability of the receiver. It was an urgent program and some of us plugged away through the night. We had been listening to the BBC as we worked until sign off time, and then we fished for something else on the radio. Germany came in loud and clear. The music was appealing. Strauss and Lehar melodies played by a full orchestra—solo arias from Vienese operettas. What? At this boar? More full orchestra—a male chorus singing songs of the Rhine and so on through the night. How could they do it? The sound was so flawless that we were convinced we were hearing live performances. The usual deficiencies of record scratch and other tell-tale distortions were completely absent.

Turn in the Road completely absent.
Turn in the Road

Turn in the Road

The mystery was solved some time later after the invasion of France. The operations center of our particular group, the Technical Liaison Division of the U.S. Army Signal Corps, was set up in Paris and our first objective was to ferret out developments in which the Germans may have been active during the war and at the time of their retreat. Two of us, for instance, were the first Ameri-

cans to get to the top of the Eif-fel Tower after the Germans were driven from the area, in order that we might see what kind of radio transmitters and receivers they had been employing from this most favorable location. It was an exciting time.

On one trip into Germany some time later, we were following some tips regarding a particularly in-triguing, if dubious, activity which had been reported. On a moun-tain northwest of Frankfort, a tow-er had been discovered in which

tain northwest of Frankfort, a tower had been discovered in which a scientist had supposedly been conducting experiments in stopping aircraft engines at a range of several miles by means of some kind of powerful radio beam. While going through the installation which was certainly awesome and reminiscent of the more spectacular moments of a Frankenstein movie, I struck up a conversation with a British Army Officer. We soon concluded from the information we were able to put together soon concluded from the informa-tion we were able to put together that the installation had been a dismal failure, but we also found we had a common personal inter-est in music and sound recording. He asked me if I had seen or heard the Magnetophon, a magnet-ic tape recorder which the Ger-mans had developed and which he issured me performed with a fantastic dynamic range from full orchestral crashes to virtual silence without background noise and inwithout background noise and in-credibly low distortion.

I told him we already had about

six such machines back at our lab-oratory in Paris but that they were quite poor in dynamic range since their background noise was not as good as a 78 RPM shellac record and their distortion had been found to be very inferior in the tests we had made. He urged me to go to the studios of Radio Frankfort and hear the performance of a machine for myself. Thinking this chap



INDUSTRY BIRTH

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must have a tin ear, I bade him farewell and began to drive down the mountain. As my assistant and I reached a fork in the road, with all intentions of turning westward, I reconsidered. Suppose he had something there after all? We turned eastward. turned eastward.

The British officer had told me that Radio Frankfort had vacated the city during the heavy bombing raids and had relocated in a large bouse at a resort spa north of the city, a small town called Bad Nau-beim. I drove there, found the bouse and confirmed that the ra-

dio station, as he had informed me, was now being directed by the U.S. Armed Forces Radio Service. The German staff was still operat-ing and maintaining the equipment. A Fantastic Experience I asked if I might hear one of the tape machines they were using an order was directed to one of the technicians. I was taken into a room in which there was a large loudspeaker and two of the Magnetophons. The mechanism appeared to be the same as the ones we had in Paris, but there was an obvious difference in the electron-

obvious difference in the electron-The technician placed a roll of The technician placed a roll of tape on one of the machines and started it. Suddenly, out of complete silence, an orchestra blossomed into being with fidelity such as I had never heard in my life. From deep resonant brass to the shimmering of the flute, it was all there. It was clean! It was free from any noticeable distortion. And if that were not enough, the dyif that were not enough, the dy-namic range was fantastic com-pared with anything I had ever previously experienced.

My assistant was very proficient with a camera and before the af-ternoon light had wanted be had

with a camera and before the af-ternoon light had waned, he had photographed all the schematic diagrams and instruction manuals, even though they were in German. I had talked the officer in charge out of a few rolls of the type of tape they were using, my gold oak leaves helping to convince the licutemant that we needed the tape for further investigation of the

Magnetophon back at our labora-tory in Paris. It seemed curious that while the AFRS personnel were busily engaged in using the Magnetophon in each day's pro-gramming, they had apparently never considered that these ma-chines were really something very pleasurable. pleasurable. High Frequency Bias Until now, the machines which had been sent in to the laboratory had received only a casual inspec-tion and then been set aside as

bon and then been set aside as having no particular significance to the Signal Corps. When we returned to Paris, I immediately pulled one of them out of our storeroom and set to work with Capt, James Menard to duplicate the electronics that I had found in Bad Naubeim, After several days' work we had the machine operating splendidly. ing splendidly. Mechanically, the machines were





The president of Ampex, Mr. Alexander Poeiatoff, was also at the convention and we invited him to hear playbacks of some of the material we had recorded. Naturally, he was most enthusiastic and shortly thereoffer the visible results. recording), they arranged to feed us some music, a plano solo by Artur Rubinstein, played back from this newest medium, a test reel they particularly prided as having exceptional quality. I recorded it on the Magnetophon. ly, he was most encountries as shortly thereafter the visible results shortly thereafter the visible results

FRANK HEALY (1) and Mullin in 1947 with one of the two Magneto

hons. Electronics were in a separate box.

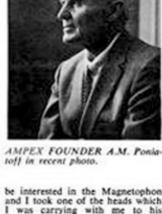
One function of our organiza-tion was to collect data and sam-ples of German developments and send them to the Signal Corps Laboratories and the Department of Commerce in the U.S. After dutifully complying with this serv-ice with regard to the Magnetophon in this more significant form, I was able to obtain two of the remain-ing low quality machines and send able to obtain two of the remain-ing low quality machines and send them to my home in San Francisco as souvenirs of war. By now we had a goodly supply of tape as well, and I was able to send home about 50 rolls of it. Each roll ran for only twenty-two minutes at the speed in use at the time, 30 inches-per-second. One of the regulations covering war souvenirs was that anything to be sent had to be small enough to fit into a U.S. mail-bag. I had to

ompletely dismantle my two ma-chines and send them, with the lape, in 18 different packages. The project was challenging and the results rewarding. All 18 boxes were at home awaiting my arrival after discharge from the army in early 1946. 1946.

atter discharge from the army in early 1946.

Because it was still not clear to any of us who had investigated the high quality Magnetophon in Paris whether or not there was something particularly unique about the metallurgy of the recording and playback heads. I decided not to send them with the packages I mailed home. Since they were physically quite small, I carried them with me in my personal kit.

En route from Paris to San Francisco, I stopped off a couple of days at Fort Monmouth, New Jersey, over the Thanksgiving holiday, 1945. Here I encountered a Signal Carps acquaintance of several year's standing, Lt. Col. Richard Ranger, He invited me to his home for Thanksgiving dinner. Knowing of his interest and reputation as a clever inventor and developer of electric organs, I thought he might



and I took one of the heads which I was carrying with me to his house. He had not until then heard of the Magnetophon and was immediately interested in its possi-

Joins Bill Palmer

Col. Ranger and my friend, Jim Menard, were still in the service. Jim was still in France and I soon learned from him, after I was back in civilian life in San Francisco, that Col. Ranger was in Europe and probing more thoroughly than we had into the manufacture of Magnetophon tape and the Magnetophon itself.

er, who had developed a successful motion picture production services company in San Francisco, Bill had established a splendid reputation in all facets of 16mm film work with particular specialization in color film duplication and sound recording. He enthusiastically awaited my assembly and demon-stration of the Magnetophon. As-sembly of the machines was, of course, relatively easy since I had taken them apart myself in Paris, but I had to build the electric cir-cuits from American tubes and components along the lines of the original German schematics and I made certain modifications which made certain modifications which I deemed desirable. I put electrical pre-emphasis, for example, into the most certainly were, in giving a demonstration to the Crosby peo-ple, if he could set it up. Crosby Demonstration Hugh King returned to Holly-wood and contacted his agent friend, Frank Healey, Healey con-tacted Murdo McKenzie, the tech-nical producer of the show. Murdo had the responsibility of all serv-



high frequency record circuit and corresponding de-emphasis on play-back. This proved to be worth-while and was duplicated later al-most exactly in the Ampex first model. By March of 1946 1 had both machines operating to my complete satisfaction. ing speakers or even a disk re-cording lathe. Their company was headed by a gentleman named A. M. Poniatoff, Borrowing his ini-

First Public Demonstration Bill and I immediately put them to work in his studio in San Francisco, where we found them most useful for recording off-screen voice and music for films. We worked out cutting and splicing techniques so that the sound track for a complete read of film (12)

for a complete roel of film (12 minutes long) could be prepared in its final form on tape. Then, a single transfer to optical sound track could be made resulting in a final product that sounded much better process. To our knowledge, this was the first time magnetic recording was ever used, at least in this country, to record sound for mo-I remember well the first public demonstration I gave in San Francisco to the local chapter of the Institute of Radio Engineers on May 16, 1947. We prepared some tapes at KFRC of orchestra, vocal-ists and pipe organ. We had a large attendance and the enthusiasm was

Little did I know that night that

among the audience were several men with whom I would later have a close and long association. Oddly enough, they were particularly in-terested in the sound of a small German loudspeaker I used as a monitor during part of my demonmonitor during part of my demonstration. They contacted us later, wanting to know if they could come to our studio to see it at closer range. We were, of course, happy to let them do so and they introduced themselves as Harold Lindsey and Myron Stolaroff, representing a small company of only six people in San Carlos on the San Francisco peninsula. They had been making aircraft motors during the war and were now looking for some new field of post-war promise. Since they were interested in high quality audio, they were considering the possibility of mak-

tials and adding EX for excellence, they had named the company Am-Film Studio Demonstratio While their first interest was the loudspeaker, this soon gave way

while local trist interest was the loudspeaker, this soon gave way to an expanding interest in the Magnetophon and it was not long before they decided the undeveloped field of professional magnetic recording should be their area of specialization.

In October of 1946, Bill and I attended the annual convention of the Society of Motion Picture Engineers (SMPE, now known as SMPTE). There were few references to magnetic recording, but one or two papers were scheduled for presentation on experimental work which was being carried on. In particular, I remember that Marvin Camras of Armour Research presented a demonstration of sound from a strip of 35mm

Marvin Camras of Armour Research presented a demonstration of sound from a strip of 35mm film which he had coated with a form of iron oxide, using a paint brush. It sounded pretty good, but didn't seem to excite the sound departments of the major studios.

Bill and I got to talking with a man who ran a rather exclusive radio-phono and record store in Beverly Hills, Art Crawford by name. He was excited about the potential for tape in the home and we told him we had one of our machines in the back of Bill's car. He was anxious to see it, so we set it up in our hotel room. He nearly flipped when he heard it and immediately got on the phone, calling Douglas Shearer, the head of sound at MGM: Tom Moulton, the head of sound at 20th Century-Fox; and John Hilliard, chief engineer of Altec Lansing. Arrangements were made with each of them for visits at their plants and the next two days saw a series of exciting demonstrations. I remember particularly the few hours we spent at MGM.

Since they had never heard of us and discounted any reports that a new sound recording system might be comparable to their lat-

a new sound recording system might be comparable to their lat-



watched by the 3M Company, who by now was making a paper base tape suitable for use on them.

Crosby Tries Tape
Our tests of the 3M tape at this time indicated that it was not for use on the Magnetophons and, consequently, I had to carry on recording, editing, playing back, and erasing the same original 50 rolls I had sent back from Germany. Col. Ranger meanwhile assured us that he would soon be making tape according to the Germaking tape according to the Germany.

Poniatoff Introduction In assembling the electronics, I had provided an "A-B" switch. In the "A" position one was able to listen directly to the source material. In the "B" position the Magnetophon playback head was used to reproduce the tape less than 1/10 of a second after it had passed over the record head. Thus, instantaneous comparisons were possible.

est system of sound-on-film record-ing (so-called "200 mil push-pull"

taneous comparisons were possible. This in itself opened their eyes They could not tell whether we were listening to their film direct-ly or on playback from the tape. Their system had the highest dy-Their system had the highest dynamic range of any available at the
time, yet when they cut off the
film at the end of the test we were
all aware of a drop in noise level,
but the tape continued merrily running on with much less inherent
noise that it was easy to tell when
the film had stopped. Their cool
welcome had given way to a most
cordial and warm visit. Before
we had left, they fed us music
from their music recording stage
where Jose Hurbi was playing piano with Georgia Stoll and the
full MGM symphony orchestra.
This was followed by an arrangement of a Roumanian Rhapsody
featuring Larry Adler, the harmoeica virtuoso. These gentlemen
all came into the recording room
afterward and shared in the enthusiasm the Magnetophon created.
Col. Passer had come to the

afterward and shared in the en-thusiasm the Magnetophon created. Col. Ranger had come to the SMPE convention and he had ac-companied us on these visits. He returned home with preat enthusi-asm, resolved to get into the busi-ness of making an American copy of the Magnetophon and its tape. We agreed to keep in touch, with the hope that W.A. Palmer & Co. could be his West Coast representa-tive when he got into production. Ranger Machines Tried

We were able to set up our machines a day or two in advance in the recording department at NBC, not without considerable concern on behalf of Les Cully, head of the recording department, who wondered about this encroachment in his "never-never-land." We shortly thereafter the visible results of Ampex interest in developing a professional tape recorder began to be apparent. Because we had a verbal agreement with Colonel Ranger, I was not able to disclose to Ampex information I had learned in the course of development and use of the machines beyond what I knew from my activities in an official capacity while in the Signal Corps. Several months passed by while Col. Ranger and Ampex both developed machines and we continued to use ours in and we continued to use ours in
the studio in San Francisco.

Bing Crosby Connection
Early in 1947, a film producer
with a particular problem which
the Palmer Co. was in a position
to service came to us one day to service came to us one day from Hollywood. His name was Hugh King and he saw us using the tape for recording and editing. He told us that he had recently

that it was necessary to make "pre-dubs" as they were called. These were short portions of the show were short portions of the show which were put together as a sec-tion; assembled from the original records by Irial and error over and over again, until acceptable. Then, of course, it was necessary to re-re-cord the pre-dub into the final as-sembly. Thus, it was that some of the material beard on the air was actually a re-recording of a re-re-cording. These parts were particu-larly deficient in tone quality.

From watching me assemble a master tape from bits and pieces and rearrange parts by the simple expedient of using a pair of seis-

expedient of using a pair of scis-sors and adhesive tage, he was the idea that this might be interested, which we ice aspects of the show from pro-curing studio space on the particu-lar days Bing desired to record, through microphone placement and audio balance in the control room, to the ultimate giant prob-lem of editing the disks into a final show and deciding on the ac-ceptability of the product. Murdo was harve to witness a demostra-

ice aspects of the show from pro-

was happy to witness a demonstra-tion of anything that might ease the nightmarish situation in which

extremely easy with my scissor and adhesive tape method, and he seemed delighted. He was furtherseemed delighted. He was further-more very impressed with the fact that playbacks of the tape sounded identical to the original disk. I did not realize it at the time, but it later became obvious to me that be had brought in disks which had

he found himself week after week Healey made arrangements for us to meet Murdo at a small recording studio in Hollywood, Mc-Kenzie brought in some disks— originals from one of the shows— which he played onto the tape and then indicated the cuts he wanted to be made. I found them

making tape according to the Ger-man formula, and that his copy of

man formula, and that his copy of the Magnetophon was coming along nicely. Ampex gave us similar reports about their recorder.

In July, we were informed that the first show for the 1947-48 Crosby season would be recorded in August at the ABC-NBC studies in Hollywood, and we were invited to be there, in the recording department, to take it on tape while they recorded on disk.

Concern was expressed for the fact that we had only the two original German machines and a limited supply of tape, but we assured inal German machines and a limited supply of tape, but we assured McKenzie and Healey that we soon hoped to have backup machines and tape from Col. Ranger. We contacted the Colonel and found he was confident he could be present at the recording session to give such assurance with two completed machines and, hopefully, some tape of his own fabrication.

to start the switchover fro trical transcription disks to magnetic tape in this country. Progenitor of American tape recorders, the German Magnetophon. Three were brought back from World War II by John Herbert Orr and John Mullen to serve as basis for Ampes and Rangertone (Lt. Col. Richard Ranger researched the project from Germany) machines (% inch tape at 30 Las with no hubs on the model and machines). was shown to the public and it created a sensation. Charles Ginsburg, with assistance from a young high school graduate, Ray Delby (father of today's Delby System) had fought the vicisalides of crumped quarters and an "off again-on again" policy, but in the face of it all had come up with a marvelous development. Of their National Association of Broadcasters demonstration, Ginsburg said: We provided him with one of our Model 300 audio machines for test and he was delighted with its per-formance. He ordered several and thus was born Instrumentation rein a short time into something much greater for Ampex and Bing Crosby Enterprises than audio had ever become.

Ampex undertook development of special machines to best fit varof special machines to bed in various requirements of this business. Early machines had a peculiarity which introduced an undesirable irregularity in the final analyzed records. This was known as flui-"At first they just couldn't be-lieve what they saw; there must have been two or three minutes of excruciating silence. Then, all hell broke loose. They were hollering and screaming and jumping out of their cent." records. This was known as flun-ter. While still working on the radio show, I undertook develop-ment of a flutter compensator, using the kitchen of my spartment in Los Angeles as a laboratory. I soon outgrew the kitchen. I had also discussed the possibilities of recording television on tace with It was clear as the Crosby sea son drew to a close in June of 1948 that a great change had taken place in the world of professional sound recording. One major net-work had converted to tape. A new seats." We soon concluded that it would

> 1950. Our first demonstration was pretty crude. We had "recorded," fretty cride. We had recorded, if it could be called that, some TV pictures of airplanes landing and taking off. Whenever we gave a demonstration, Frank would stand by the monitor and my, "New watch this plane court in for a watch this plane coute in for a landing," or "There goes a guy on take off." It is doubtful the viewer would have known what he was seeing without his running com Things got better at a rapid pace, however, and by January of 1952 one reporter stated "The pic-ture seen is on a par with live TV

and in its usual cooperative man-ner, 3M was constantly furnishing us with samples of experimental oxides and base materials.

Whenever we had an improve-ment to show, we invited people from Ampex and 3M to come and are it. We didn't know for some time that in between demonstra-tions and part persistent research. a lone but persistent research method of recording TV on tage in a converted ladies washroom at Ampey. Each time after we had

though there was still room for improvement and, of course, our development efforts continued. Ampex Video Breakthrough Parallel with our developm of video tape recording, which in-cidentally we named "VTR" at our first demonstration in 1951, we up

given up entirely and we had the southwest area of the U.S. for instrumentation. This was, however, the best territory, since there was so much government activity in this district. We ma de several machines, unbe unprofitable to continue development of our video recorder. Ampex informed Bing Crosby Enterprises that they wished to bandle the instrumentation terrifory we had been selling and servicing, and so the electronic division of Bing Crosby Enterprises was left with Crosby Enterprises was left with only a few good contracts for spe-cialized wide-band recorders, and some capable personnel.

Freedom from the restrictions of activity that were formerly im-Ampre now permitted us to en-gage in the design and manufacture of any type of tape recorder we fight choose to make. We knew the area and the customers. Bing felt

mained as head of engineering.

We immediately set to the task of designing a standard instrumentation machine, our Model C. Thanks to JM's interest and faith in our future, we expanded into new quarters in West Los Angeles and immediately grew at a remarkable piece. Soon Minoom occupied several buildings in the area and it become desirable to consolidate. In 1962, the Division was moved to its own new building in Camarillo, where it operates at this writing.

Today's Tape Recording
Thecame detached from the operation, taking up residence in General, Switzerland, in 1962 on a special resignment. Before leaving

we continued its development. In 1966, Don Kahn and I moved back to Mincom in Camarillo and our first machine was delivered from the Mincom plant in January, Today's professional audio re-corder is a far ery from the Mag-netophon. It may have several specifs and provide as many as 24

specifs and provide as many as 24 separate tracks on 2-inch tape. The Magnetophon ran at one speed, and recorded on track on 54-inch tape. Tape is finally finding its way into the home. Today's cassette machines run at 1% inches per second and provide four tracks on tape only 0.150 inches wide.

The hesitancy of the professional recording session to a tape may recording session to a tape may recording session to a tape ma-chine was understandable in 1947.

in adjustment for long periods of Today there are very few places where disk or optical film recording is done directly from the live score. As I write this, in 1972, it can be observed that exerwhelminally there is now only one media ingly there is now only one medi-um in use for original sound re-cording and for most instrumenta-

tion recording—the magnetic cu-ide costed on tape or film.

Then that awesome moment of playback. Murdo asked first to hear the Ranger machines. My heart sank! The distortion on the peaks was excessive and the background noise was too high. Murdo indicated "cut" and then inded me indicated "cut" and then inxed me to play one of the Mupnetophones. We were in!

That night, Col. Ranger and I had a long talk. He was convinced he had carried the development of his machine to a point of acceptability and that an any event he must now sell these two machines as they stood. He had put a lot of money into them and was anxious to realize some return. It was

obvious to me that they were not acceptable to the Crosby people and I tried to convince him of this.

Fortunately for him, he was able to sell both machines in Hollywood

ment in his "never-never-land." We then met Col. Ranger at the Union Depot. He had come by train and had indeed brought two machines

with him, but alas, no tape. He set up his machines the next day, Thus, we came to the most un-

forgettable moment in my life. The show was performed in the early evening. NBC's recording depart-

are treed it down on several disk lather simultaneously, while Col. Ranger and I recorded it on tape on our respective four machines.

to sell both machines in Hollywood within a few days, with the assurance that he would at some time later update them to provide better quality performance. He sold them to Harry Bryant at Rudio Recorders. We still needed backup machines if we were to take on the Crosby show, and even more important, we were going to need tape. We were not confident that we would get either from Col, Ranger and so we terminated our relationship. relationship. Crosby Goes Tape We immediately contacted Am-pex and I can remember my ex-cited enchusiasm as I called long distance to Harold Lindsey and Alex Poniatoff to convince them of the great opportunity that seemed to lay at their doorsten. They had already accomplished a great deal, but there was yet a lot of week ahead of them before

they would have a completed re-corder. They had no intention of trying to make tape.

A conference was held and the decision was made to let us take on the radio show if we were quite certain that Ampes would produce a machine within reasonable time. We would then have rockep protection and the operation might ultimately be expanded to the use of tape playback directly to the network. The plan meanwhile was to record on tape, edit the tape into a show and then transfer it to a disk playing the single peneration disk on the air. My limited number of reels of tape could then be reused over and over until, of course, they would be consumed in solices. they would be consumed in splig But we hoped for relief before this would happen. Murdo McKenzie procured

Murdo McKenzie procured a small studio for our exclusive use in the NBC building and I in-stalled the two Magnetophons and set about recording an average of one show a week. The rest of the time we were involved in assem-bling the final version, transferring the show to disk, and in giving demonstrations to countless visi-Good news travels fast.

Good news travels fast. 3M very shortly got wind of our operation and we were promptly visited by President William Mc-Knight. Vice President George Halpern, Robert Westbee. Dr. Wilfred Wettel, Roy Gavin, Bob Herr, and Tom Gibbons—among others. It was our first meeting with gentlemen from 3M and they made it clear that they were most anxious teem from 3M and they made it clear that they were most anxious to cooperate in any way possible to further the use of magnetic recording type. Frank Healey, Murdo McKenzie and I were most impressed with the fact that they were willing to try to fabrical whatever. willing to try to fabricate whatever formulation would work best on my machines.

Search for Tape Stock I tried many different samples, finding that there seemed to be considerable variation in their performance. Oddly enough, the types of tipe that Dr. Wetzel and Bob Herr thought should perform in a superior manner created a variable beckerning or other these beckerned policy.

formulated what they considered to be a lower grade oxide was the excellent performance of the Ger-

man tape duplicated.

He told us that he had recently been talking with an agent who told him they were having a very difficult time with Bing Crosby's radio program on the ABC net-They had been recording it on disk and then editing from disk to disk with losses in quality which were quite drastič. Furthermore, the difficulties in making some of the cuts and assemblies of parts which were desired were enormous. At times this was so complicated that it was no extracted to the com-

be a useful technique for Bing's radio show. He asked us if we

I often took short trips to Am-pes to help them with their design

and to give them practical tips on the human engineering aspects gleaned from my constant work with the German machines.

As the design come to its final fruition, we had a conference at Ampex on the type of tape to be used. Dr. Wetzel was at the factory

and we compared the performance

and we compared the performance of various lapt samples and some of the German tape. Again we drew the same conclusions that I had reached—the oxide 3M considered inferior was the one that worked best! Dr. Wetzel made it clear that 3M would gladly make this material available if we really wanted it. The decision was made

vanted it. The decision was made

This became known as Type 112 or RR (for Raven Red), a material

which we naive tage machine users and developers did not know at the time was a form of iron oxide used in red barn paint! Later we were to find out that a peculiarity of performance both in my machines and in the first Ampex models use a responsibility of performance.

els was responsible for our observations. Machines were later modified slightly to accommodate 3M's better tape, Type 111.

Ampea was built around six men

Ampec was built around six men at the time, all very capable and dedicated to one objective—to design and manufacture a professional time recorder based on the original Magnesophon, but not necessarily a Chinese copy of it. Alex Pontatelf, Harold Lindsey, Myron School, and Correct Smith state.

Stolaroff and Forrest Smith

demonstration.

With a firm order for 12, hardled through Bing Crosby Enter-prises as worldwide sales organi-zation for Ampex, the comany was able to get a bank loan that vapor-

ized their money problems. They went ahead full steam, not only to solve their remaining technical

problems, but to get set up to manufacture their first machine known as Ampex Model 200, I

manufacture their first machine known as Ampex Model 200. I was made a present of the first two to leave the factory, serial numbers 1 and 2, which I received in April, 1948.

3M Answers Tape Need I had by now recorded 26 half-boar Crosby shows on the two Magnetophons. They were showing visible signs of fatigue and my original 50 rolls of German tape were battle scarred with innumerable "bandaids."

What a relief it was to start afresh with brand new beautiful machines capable of running continuously for 35 minutes instead of only 22 and an inexhaustible supply of 3M tape.

Serial numbers 3 to 12 went to ABC, and I later turned over serial

then and there to use it.

been most difficult to edit and which had necessitated use of the "pre-dub" technique. No further commitments on either side were made at the time and we returned to San Francisco. By now, tape machines of rea-By now, tape machines of rea-sonably good performance were beginning to appear on the non-professional market. Perhaps the best at the time was the Brush Soundmirror, which was consider-ably better than the quality of die-tating machines, but well below professional requirements. Such

numbers 1 and 2 to them to com-plete the original order. This was done because these were cabinet machines—quite large and difficult to transport. It was clear that if the machines were more readily portable. Bing could go where he hixed, recording right on the spot. Thereafter, Ampea designed and made for me two portable units in which the original cabinets were each split into two beautifully fin-ished ask cases. I was presented with serial numbers 13 and 14, and I used these for the duration of my association with the Bing Crosby

name, Ampex, had come into the world of sound recording, and 3M had found the key to the future in large scale users of recording tape. asso discussed the possibilities of recording television on tape with a highly respected engineer. Wayne R. Johnson, and we found we both believed in pursuing the same method. Frank Healey and I ap-A whole new approach to radio programming was commencing— the pre-recorded, edited and assembled radio show was now to be easily accomplished. As bead of the sales organiza-

he easily accomplished.

As bead of the sales organization for Ampex products in Bang Grosby Enterprises, Frank Healey kept me busy with demonstrations to myriad prospects for this new medium. Between such activity, my continuing involvement with recording and editing the Crosby show and even providing recording and editing services to the Louella Parsons show on Sunday and weekly quarter bour show featuring Burl Ives, I was now a full time resident of Southern California. I could not devote any time to the San Francisco activities of W. A. Palmer Co., and I thus joined Bing Grosby Enterprises as chief engineer of its electronics divason. Frank quickly sold a block of machine, to NBC, then the Don Lee radio network and CBS. Independent radio stations such as KSL in San Lake were early customers.

Record Firms Try Tape

I am sure I set up the first soccessful demonstration in the use of tape for phonograph record work in mid 1948 when we were in New York. By telephone line, I fed two or three of Bing's songs from the ABC studios in Rockefeller Center quality known in television's earlier days." Through all this develop-ment period, the special character-istics which the tape itself would or three of Bing's songs from the ABC studios in Rockefeller Center to Decea Record's cutting room, where they took them on 78 RPM require became ever more evident and in its usual cooperative man-

fruition.

I continued to record the Crosby shows until June 18, 1951. During this period, Bing often recorded in San Francisco and New York. We even did some shows in Vancouver and Spokane, his old home town. As certain new techniques in editing developed, I was able to add a third machine to my apparatus. This time I was again borored to have the first machine of a new series. Model 100, Ampex' most famous line. It was made up in two portable cases and seemed a featherweight beside the Model 200's. strumentation Tape Ca

Instrumentation Tape Case
Shortly after Ampex started
making the Model 300, I was visited by a man from the Naval Station at Point Mugu, Calif. He told
us that when they launched an experimental vehicle a great deal of
information on its performance
was sent to home base by radio,
where it was instantly analyzed
and caused to operate pen recorders, among other devices, to that
complete records of the flight

method. Frank Healey and I ap-proached Crosby Enterprises, and arrangements were made to hire Johnson and one or two assistants and move into a small shop. This was the start of Bing Crosby En-terprises Electronic's Division. We opened our taboratory in June, 1851. Videotope Is Born We continued the devopment of the flutter compensator and started tackling the problem of video re-cording. I had prepared a patent application on the video recording method we were to follow, which had been filed on November 14,

ad Ampect and the officials with a demonstration, they returned to Ampex and promptly turned him off. After a time they would tire of his pleadings and let him again nick up the project. On February 23, 1955, we had a press showing of a color TV playback, Reaction was good, al-

stast demonstration in 1951, we un-dertook to develop specialized in-strumentation recorders for appli-cations where there would be no conflict with Ampex' market. By now Bing Crosby Enterprises was no longer exclusive distributor of Ampex products. Audio had been

We made several machines, under special contract, designed to
record frequencies as high as two
or three megacycles, capitalizing
on what we had been learning in
TV recording. Some of these were
speciacular jobs. The first, for
Westinghouse, a single set of equipment, sold for \$125,000.

I was suddenly surprised one
day in 1955 to be invited to the
Ampex factory in Redwood City
to witness a demonstration. It was
a video recorder that clearly outperformed a nything we had
achieved. A month or two later it

area and the customers. Bing felt that he did not want to be in the electronics business anymote. The turn of events had been followed closely by our friends in 3M Company. They felt we had good potential for growth and an agreement was signed on August 31, 1956, wherein we became the Mincom Division of 3M Company.

Frank Healey's experience as director of the old electronics division naturally assured him the directorship of Mincom, and I remained as head of engineering.

We introduitely set to the task

eration, taking up residence in Genera, Switzerland, in 1962 on a special resignment. Before leaving California, it occurred to some of us that our old "first love," the field of professional audio recording, had been sorely neglected for a long time. Thus it was that Ken Clunis, Don Kahn, and I undertook development of a new professional audio recorder. I left it in their hands when I went to Switzerland. They moved to St. Paul, Minn., in 1962 and I rejoined them there in 1963, where we continued its development. In

He had confidence in the perform-ance of disk cutters and photo-graphic systems, even though these had many variables and were diffiruit to keep in top-notch performance. He soon learned that the tape recorder was simpler to use, had fewer variables and remained

Pomaterf, Harold Lindsey, Myron Stolaroff and Forrest Smith were responsible for engineering, styling, and manufacturing methods. Both Bill Palmer and I-had great faith in what they were actomplishing but they needed money.

The name of Bing Crosby garried a lot of weight in the executive offices of ABC and as the grand plan for getting the Crosby show from tape directly onto the network took shape, it appeared that it would be desirable for ABC to have a total of 12 machines, four in New York, four in Chicago, and four in Hollywood. An order would be placed with Ampes for 12 machines if a successful demonstration was given of one machine in Hollywood. A date was set as a goal.

Ampes worked night and day, and Harold Landsey carried the and Harold Lindsey/carried the muchine to Hollywood in his sta-tion wagon. It was a beautiful thing to see, it handled tope well disks, processed them and mar-velled at the results, Capitol Rec-ords and Decea were the first rec-ord companies to install tape; Am-pex, of course, for mastering, thing to see. It handled tope well at normal speed, rewind, and fast forward. It could play a tope benutifully trapes recorded on my Magnetophon being used for demonstration). But it could not record! Time had not permitted the completion of this part of the machine. Jim Middlebrook, the chief audio facilities engineer of ABC had come out from New York for the demonstration. He got me aside and said "I want to isk you one thing." pex, of course, for mastering. Others quickly followed. As I look back on it now, it seems curious that a number of visal factors, each essential to the success of the whole, came togeth-er almost simultaneously. First the er almost simultaneously. First the Magnetophons' superiority to any-other machines in this entire country; second, the need for such apparates by such a prominent person as Bing Crosby; third, a small but capable group of people, Amper, with determination to make the world's finest tape recorders; and fourth, the 3M Company with faith in magnetic tape and anxious to see the market for it come to fruition. Yes sir." I wondered what v "Will these guys get this thing to record as well as your does?"

What a spot I was in. But I plunged beadlong into the answer.

They certainly will. There's no reason they can't.

"That's all I want to know," he and. "Fill recommend we give them the order for 12."

I really said a prayer every night for their success after that, until I witnessed a successful recording

complete records of the flight could be available for later study. This entailed a lot of people and a great deal of apparatus, all of it hopefully in good operating con-dition. He felt it would make better sense to record the signals that came out of the radio re-ceiver onto tape and then analyze them individually at a later time.