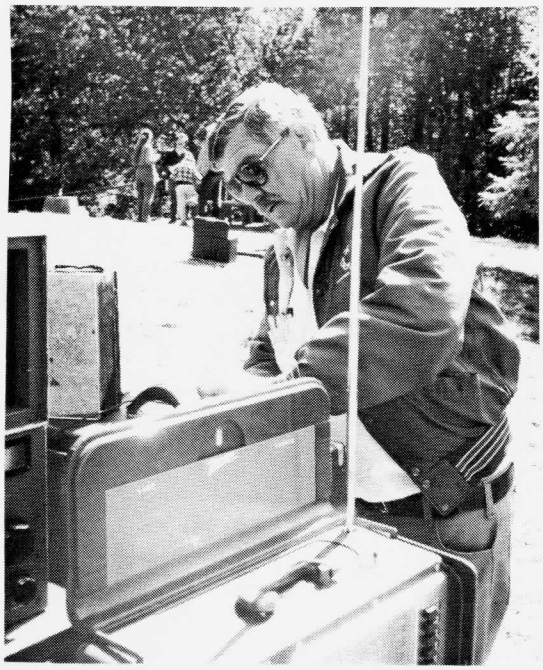
THE

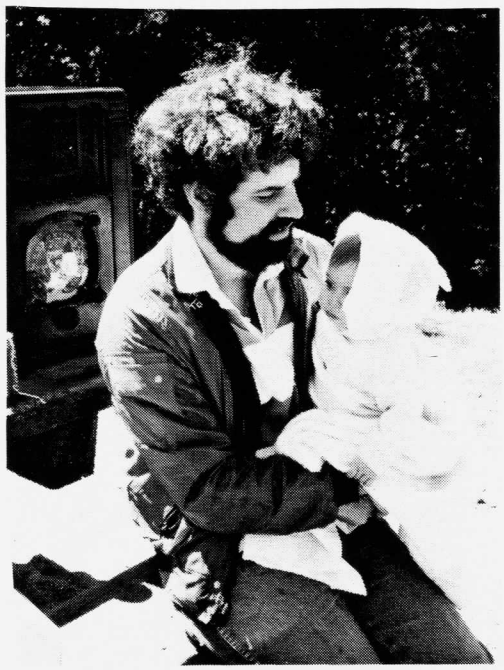
JOURNAL

OF THE

CALIFORNIA HISTORICAL RADIO SOCIETY

SPRING 1991 FOR THE RESTORATION AND PRESERVATION OF EARLY RADIO AND RADIO BROADCASTING VOLUME 15, No. 2





WHAT'S INSIDE

The California Historical Radio Society

INQUIRIES: General information about the CHRS: Paul Bourbin; Membership information, dues renewals, name badges: Adam Schoolsky; **All** *Journal* material: Bart Lee or Adam Schoolsky.

MEETINGS and SWAP MEETS: CHRS meetings are held 2-3 times per year. Locations are announced in CHRS publications and by mail. Swap meets are in February, May, August, and November at Foothill College in Los Altos. Regional meets at various Northern California locations are conducted from time to time. Contact the Public Relations Director if you want to sponsor a swap meet in your area.

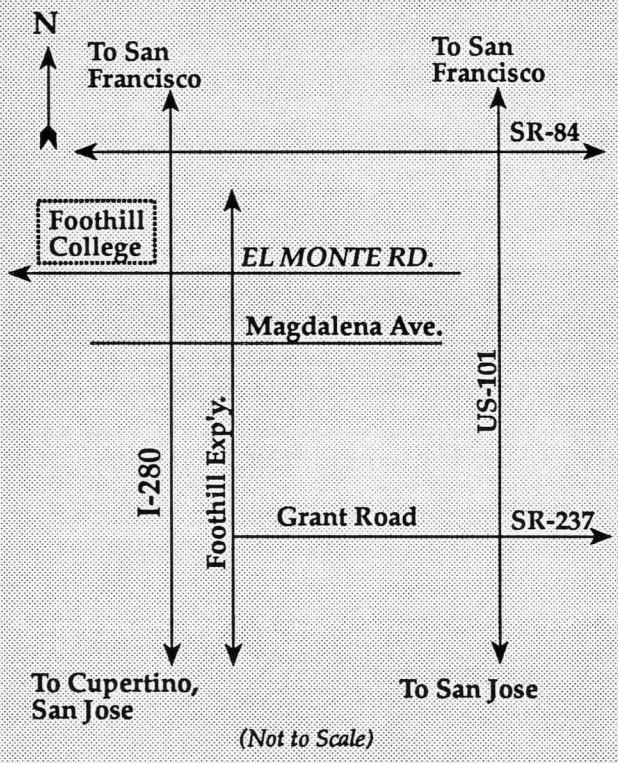
ABOUT CHRS

The California Historical Radio Society is a non-profit corporation chartered in the State of California, and was formed to promote the restoration and preservation of early radio and broadcasting. Our goal is to provide the opportunity to exchange ideas and information on the history of radio, particularly in the West, with emphasis in the areas such as: collecting, literature, programs, and restoration of early equipment. The *Journal* of the CHRS is published quarterly, alternately in printed and audio tape format, and is furnished free of charge to members. Yearly membership dues are $15.00 (US funds, please).

Submissions for the *Journal* are always welcome. Typewritten copy is preferred. Articles submitted on 5.25 inch IBM or 3.5 inch IBM or Macintosh diskettes in ASCII or Microsoft Word are appreciated. Send all material to the editor and include your name, address and phone number.

Map to Foothill College Swap Meet

Go to Lot "T" at the Northwest side of the campus.



Bird's Eye View

Paul J. Bourbin, President CHRS

Just came home from the second annual CHRS picnic. Many CHRS members, families and friends had a wonderful time at the Owl Campsite, Tilden Park, Berkeley, CA. All types of battery sets were displayed and playing. There were early battery sets, farm sets, battery portables from the thirties and forties as well as crystal sets and even a Philco Safari and a Sony Watchman portable TV sets! It was a nice time for CHRS members to socialize and for members' wives to swap stories about their radio collector husbands.

The first Marin-Sonoma meet was quite successful with about twenty sellers and a large number of North Bay members in attendance. A group from the North Valley Chapter also came. The gods of weather were smiling on us because the rain occured before and after the meet but not during. Business was brisk; one fellow had help unloading his pick-up before he even got it parked!

The next swap-meet will be at Lot T, Foothill College, Los Altos Hills, CA on Saturday, 4 May starting at 7:00 AM. More and more people *are not* arriving until the official starting time, let us hope this trend continues. It makes it easier for everyone. In addition to the regular meet activity, there will be the auction and raffle. Adam Schoolsky will have samples of our new membership badge and will be taking orders. They are $6.00 plus $.75 postage each and can be ordered from him at any time. *The rest of the Foothill meets will be on Saturdays; 3 Aug. and 2 Nov. The San Luis Obispo meet will be on the twenty-nineth of June.*

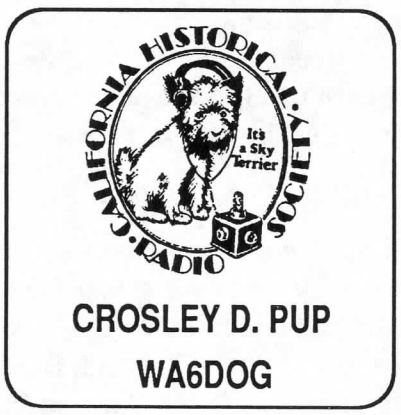
CHRS will again participate in the San Jose Historical Museum's Living History Days on the weekend of 18-19 May. We need people to bring radio related material and to help set-up as well as watch the exhibit during the event. Anyone interested in helping (and perhaps turning a few leads) please contact me.

Another event in which CHRS has been quietly participating is that of sending transistor radios to children in mission schools in Nigeria. About six months ago, I started receiving letters from children in Nigeria addressed to CHRS requesting transistor radios. How they found out about CHRS I do not know. Apparently, the villages in which these children live have no radios or other electronic connection to the outside world. I have been sending a package containing a transistor radio and a couple of batteries to quite a few children. I have been footing the bill, but it does get expensive (about ten dollars for the radio, batteries and postage), and I can use your help. If you have any pocket transistor radios that use the standard nine volt transistor radio battery that you do not need, please send them to me so I can fill the requests. The manufacturer or country of origin are unimportant. All they have to do is have the standard AM band and be working. If you have any radios, please let me know, your help will be greatly appreciated.

How do you like our new *Journal* cover? Adam Schoolsky had some assistance from a professional graphics designer. Little by little, we are upgrading the *Journal* thanks to your support. Thanks also to Chris Buttery, Ed Sharpe and the editors for their contributions. Without them there would be no *Journal.*

Guess that's it for know. See you at the meets!—PJB

ORDER YOUR NAME BADGE TODAY!



These terrific name badges are CHRS blue on a white background. Your badge is custom engraved with your name and Ham call letters. The clasp is a pin with a safety swivel. Clip ons are available for a nominal extra charge. Send your check for $6.75 (add $1.50 for clip on) payable to CHRS; and mail to Adam Schoolsky. Allow 6 weeks for delivery.

Collector Spotlight: Not Just a Bunch of BBS!

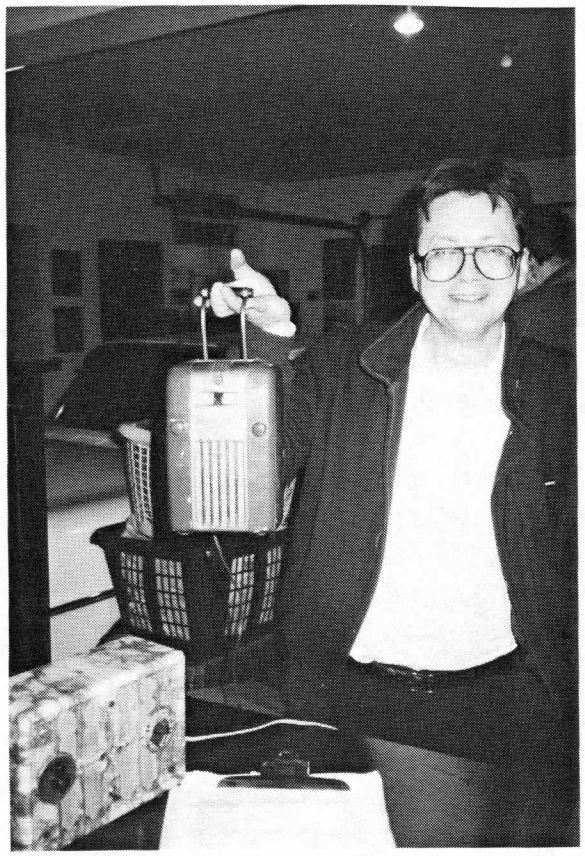
What is an ALL ANTIQUE RADIO BULLETIN BOARD SYSTEM? It is an elecronic magazine that users can access with a modem and computer. Lee and Reggi Allder are radio collectors and have started an electronic magazine on the Computer Bulletin Board System. This BBS is dedicated to Antique Radios and related topics.

Lee enthusiastically told me, "There is a big differience between an on line magazine and magazines printed on paper. An on line magazine is a liquid, interactive product. Instead of sitting pasively and reading the publication, the user may enter into the magazine and is able to contribute to its content."

Radio collectors who have articles or information to share with other collectors don't have to wait for an editor's approval. The writer is able to call the BBS and upload an article for others to read.

How would you like to instantly place an ad for something you wanted to buy or wanted to sell? The Antique Radio BBS allows a collector to type, (or upload), an ad directly into the electronic magazine.

How would you like to leave a public message, (to be read by other radio collectors)? Callers of the BBS may leave a public message, to be read by anyone who calls the BBS Magazine; or BBS users may leave a private message to be read by a specific person. In the message area of the BBS, collectors have given their opinions about radio prices, radio trends, and Catalin collecting. The message area of the BBS is a good way of making new "radio collecting" contacts from all over the country.



Lee Allder displaying one of the family "Jewels."

Reggi told me, "Even if collectors don't have a computer or modem, they may still participate. Anyone who wishes, may send a for sale or want list and we will post it on the BBS for FREE!"
If you would like to access the BBS, call (415) 491-0214, 6 AM-12MN PST (or PDT), 7 days a week.
Settings are: 300/1200/2400 Baud. Bits/Parity/Stop: 8/N/1
Their mailing address is: All Antique Radio BBS, P. O. Box 6735, San Rafael, CA 94903

CONTEST WINNER!

Zep Bennett's high score won the McMurdo Silver serviceman's contest. He would have been eligible to become an authorized McMurdo Silver repairman. Zep will receive a free years' membership in CHRS. Congratulations!

CHRS Southwest Correspondent's Corner

Edward A. Sharpe, Archivist SMEC

Many of you have noticed my lack of attendance at the recent swap meets up there in Northern California. It isn't that I didn't want to come, but that I just got sort of buried! Our daughter has gotten older and started collections of her own, the house needed painting and became too small, so to remedy all of these problems a new house was purchased. Opps! They don't landscape the yard in this new subdivision...

HI HO HI HO!
OFF TO WORK WE GO!

After a few months of beating a 35 Lb. iron pick into the ground and moving semi-loads of gravel and top soil about, and paying the bills from the nursery (since I was not patient enough for trees to grow, I wanted them big to begin with!) The net result was a job well done and me weighing 50 Lbs. less. At that point early electronics came back into my life!

ENTER: MONTHS OF RESEARCH...

I got my chance to explore the early history of the transistor and other solid state marvels. In addition, I explored the communications satellite Telstar.

Transistors and the space age! The tiny device that has changed all of our lives is included in almost every piece of technology that we handle in the passage of a day's time. Had not the pioneering engineers and scientists done this development work, the items we use in our existence today would have been vastly more bulky. From the exploratory work on transistors and diodes came IC's, and the size continued to decrease!

It does seem perhaps odd, that what we considered modern day marvels not that long ago, are now in a museum. As technology marches on, what was a marvel only yesterday is replaced by yet something more fantastic. To keep our country on course, not only do we need to look to the future, but also study our past history, both the achievements and the failures.

The Museum has acquired the vast collection of early semiconductors that belonged to K.D. Smith, an early engineer at Bell Laboratories. Along with the semiconductors there are early prototype Western Electric tubes as well. We are fortunate to have many of his original notebooks on file in the library, to serve not only us during our passage through this existence, but also for the use of those that will follow us.

I would like to thank Morgan McMahon, Jim Early, Ivan Saddler, Bob Ryder, John Bardeen, Howard Dicken, John Fairfield, Cullen Moore, John Pierce and A.C. Dickieson. Their intellectual support was necessary. When I surveyed the K.D. Smith collection, these innovators were essentially my teachers and guideposts. Without their help VINTAGE ELECTRICS, the Museum's yearly publication, (you may obtain) would not quite be in the order it is now. I also have them to thank for the 'personalized' education in semiconductor development that I have received!

The encouragement and support shown to the Southwest Museum of Electricity and Communications and VINTAGE ELECTRICS by those in the Radio Amateur field, is to be commended. This technically aware militia has resulted in the preservation of many items.

We also acknowledge the encouragement and support shown us by members of the engineering community. These fine fellows have contributed time in tracking down information, spotting artifacts out in 'the rough', bringing by old engineering text books and in countless other ways.

To the younger folks that visit, you are indeed our prime motive force of encouragement! The amazed look in your faces and the questions you ask, reinforce that the actions we are taking to preserve our technological past is worthwhile! Although those of us who have passed through the phases of technology enjoy the items on display, in reality, the museum is here for you!

One thing all of us should consider; vintage electrical technology daily hits the land fills across America. Only, if we make a dedicated effort, will the artifacts and literature of our technological history be preserved. It is up to all of us who know the history of an item to make sure that it will be kept secure for future scientists and engineers to study.

The museum is seeking items that would be of interest to the people who indulge themselves in research at our facility, as well as those younger folks who come just to find out how an old telephone or radio works. Please do not dispose of anything before contacting us! -EAS

We are looking for any info relating to the McCarty Wireless Telephone Company.

Please call us or drop a letter if you have anymaterial relating to McCarty.

Southwest Museum of Electricity and Communications
2224 W. Desert Cove #205
Phx. Az. 85029 (602) 861-1388

HP FOUNDERS IN ENGINEERING HALL OF FAME

Hewlett-Packard co-founders Dave Packard and Bill Hewlett were among four outstanding engineers inducted into the Silicon Valley Engineering Hall of Fame at an awards banquet on Thursday, February 21, in San Jose, California.

The event, sponsored by the Silicon Valley Engineering Council as part of 1991 National Engineers Week, also honored Dale Compton, director of NASA Ames Research Center, and Esther Williams, reliability engineer at Lockheed Missiles and Space Co.

Compton is a pioneer in planetary atmosphere entry, hypersonic aerodynamics and physics of high-temperature gases and in earth science. Williams is an internationally recognized expert in aerospace materials and failure analysis.

Hewlett and Packard are cited for "distinguishing themselves both in engineering management and in service to the profession, to the community and to the federal government..

The Silicon Valley Engineering Council represents thousands of engineers of all disciplines. - HPNN 1991-

Congratulations Bill and Dave! - EAS

The Southwest Museum of Electricity and Communication

Edward and LeeAnn Sharpe are beginning to realize a long held dream of establishing a museum for the preservation of books, papers, and artifacts related to the history of electricity and communication. The museum, named **The Southwestern Museum of Electricity and Communications,** is housed in the same industrial park as their business, Computer Exchange, which distributes Hewlett-Packard products. The task entrusted to the museum is that it serve the residents of the Southwest and all visitors as a research and educational resource.

The exciting new museum, consisting of a display facility and reference library, is entered through the Computer Exchange located in Suite 205, 2224 W. Desert Cove, Phoenix 85029.

While the general public is cordially invited to make use of these resources, a limited number of visitors may be accommodated at any one time due to the rarity of the material, and the large amount accumulated in a modest space. Present plans are to conduct tours on Friday afternoons, or at other times as business obligations allow. Reservations may be made by calling Ed Sharpe at (602) 861-1388.

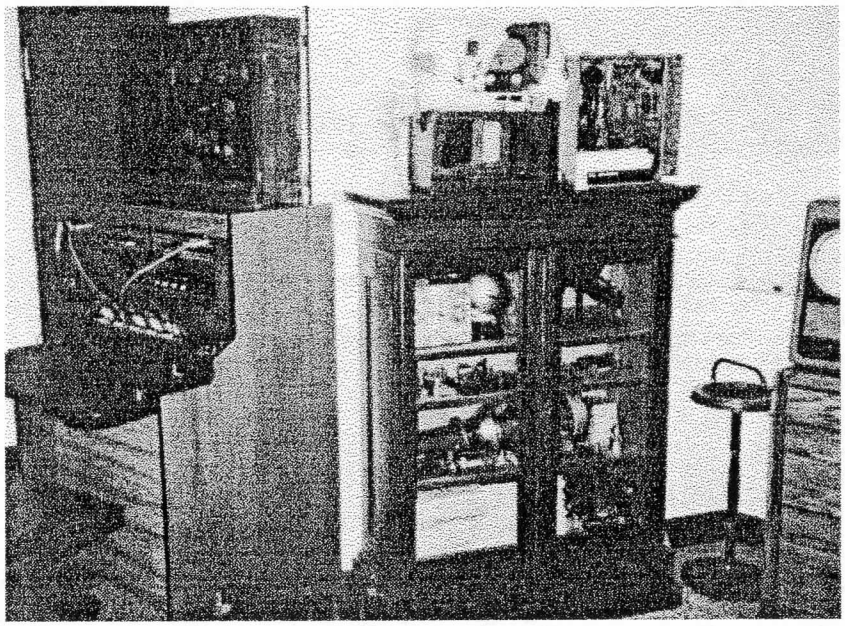
Younger folks are most encouraged to visit the museum;
however, persons under the age of 18 must be accompanied by a responsible adult.

The library is by necessity for reference only. A study area is provided. Among the publications on radio available, for example, are various books written largely in the 1920's, but also before and after; technical manuals such as the Rider's Perpetual Trouble Shooter's including the television series, magazines such as Wireless Age 1913-1923, Modern Electronics 1909-1915, Radio, Radio News, Radio Broadcast, Radio Engineering and many more. For those interested in early telephones, bound volumes of Telephony spans the years 1901 though 1974, while some books on telegraph and telephone go back as far as 1877. The many bound volumes of the Bell Laboratories Record and Bell System Technical journals deal with a range of electronic research and applications, including the exciting development of the transistor! Much of the printed at some point will be in an on-line computer indexing system, so that even people that are outside the state will be able to check to see if a title is held here. The recent acquisitions of micro-film and micro-fiche reader machines adds to the potential for acquiring on micro-film other scarce material for study.

Publications that are urgently needed are the proceedings from the AIEE, IRE and IEEE. Other publications as the Journal of Applied Physics and some of the chemical journals relate to the early development of solid state are needed as well.

The museum has on hand many forms of repro-graphic equipment for the researcher to use during their efforts. Xerox machine, printing micro-film viewers, 35 mm camera, and computerized scanners make the recording of data an easy task for that individual.

The museum's vast displays of electronic equipment are arranged to exhibit early wireless communication, early radio broadcast history, early amateur history, microphones, military communication equipment, telegraph and telephones. There are other sub-sections dealing with precision machining, scientific instrument making, microscopes and early data processing. The Southwest



Many articles document the life of K.D. Smith, an early Bell Laboratories engineer to whom this issue was dedicated following his death, telemetry of early converted V-2 converted rockets used during the early part of the US space efforts by Cullen Moore, the development of Echo and Telstar or first communication satellites by John Pierce and James Early, An in-depth interview with A.C. Dickieson on the TD-2 Microwave relay system and Telstar that he was the project manager for, RCA and it's involvement in color TV and semiconductors by Ivan Saddler, History and background on early semiconductors and insight on how Hughes Aircraft used them by Morgan McMahon, degradation in early sold state devices since date of manufacture by Howard Dicken, Diffusion process in semiconductors by John Fairfield, The friendly effect in early transistors by Robert Ryder, and much more!

Museum of Electricity and Communications is looking to further broaden it's scope into other areas as well, since many of the technologies are interrelated from the standpoint of research and manufacturing. The earliest communication equipment in the museum are early telegraph equipment from the 1850's and a telephone made in 1878, both by the Charles Williams Electrical Works, who was an instrument maker for Alexander Bell during the time that he began to supply telephone instruments to the public.

Among other plans for the museum, is the loaning of selected artifacts to schools and other museums. In this manner, the museum will act as a repository for the early technology, and the written history that other museums can only devote a small amount of space to, but have the artifacts on tap for their use at any time.

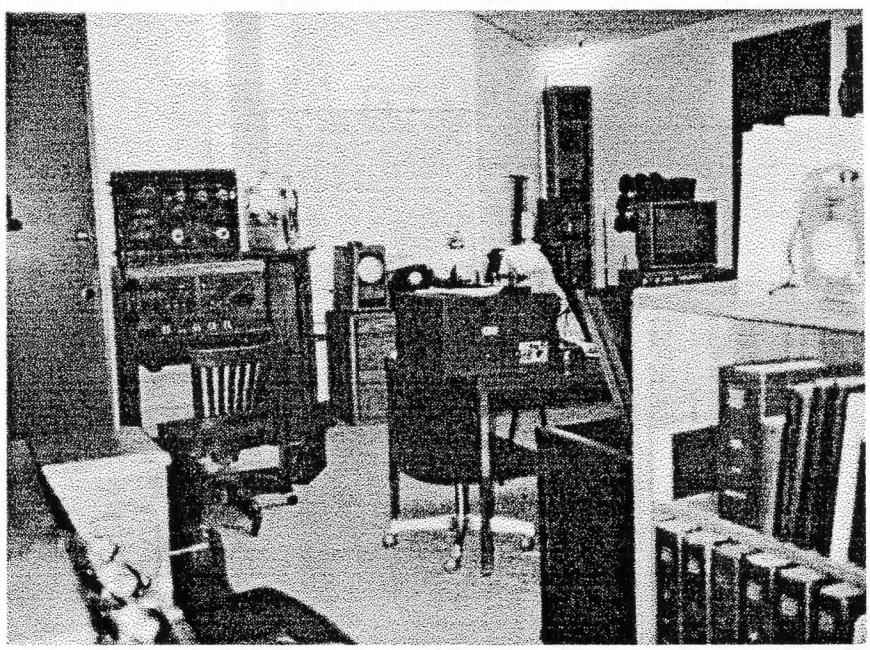
Both Ed and LeeAnn Sharpe are very interested in gathering more of the above mentioned material and anything remotely relating to it. Items that are in need are advertising signs and more hardware, books and original papers by inventors, as well as patent documents. Please contact Ed Sharpe at (602) 861-1388 in the daytime if you can supply any of these much needed items.

The museum is undertaking a large documentation project on the early development of solid state technology. The yearly journal, VINTAGE ELECTRICS (a small pun on Gernsback's MODERN ELECTRICS title) was over 90 pages long, fully indexed, and had many interviews with the people that developed the technology. One key article was a accounting of how John Bardeen was involved in the early development of the transistor while at Bell Laboratories. This was the last released technical article by John Bardeen before his untimely death in Jan. 30, 1991, from heart failure.

Here is your chance to read about the technology written by the inventors, as well as gain valuable insight as to the humor, as well as the horrors, that happened along the way. You will not see this in any formal release article about the technology from the companies that brought it forth.

Copies of the Museum's journal, VINTAGE ELECTRICS, are available by sending $10 to: Computer Exchange, 2224 W. Desert Cove Rd. #205 Phx. AZ 85029.

Another goal of the Museum is the documenting and collection of artifacts relating to the early days of satellite communications. Artifacts and written material are urgently needed in this area. Even though it does not seem that long ago, Explorer, Echo, Telstar, Advent, Tiros, and other satellites are indeed history. If you were ever involved with any of these projects please contact the museum.



As the accompanying photographs may suggest, the museum is a welcome resource for all radio buffs, students doing research, company historians, as well as being an exciting means for educating future generations.

This is your museum, come visit it when in town!

VINTAGE ELECTRICS VOLUME 2 ARTICLE LIST

Family and Friends Remember K.D. Smith
Dave Smith, Ian Ross, James Early, Robert Ryder
Early Days of the Transistor
John Bardeen
Transistors or Serendipity
Cullen Moore
Echo and Telstar
John R. Pierce
The Friendly Effect in Transistors
Robert Ryder
1951 Transistor Symposium At Murry Hill
Duplicating Ma Bell's Cooking
Morgan McMahon
The Diffusion Process
John Fairfield
Telstar - Dawn of a New Age
James Early
Changes in Solid State Devices Since Manufacture
Howard Dicken
Early Solid-State Work at RCA, and Other Stories
Ivan Saddler
The K.D. Smith Collection
A.C. Dickieson, Telstar's Project Manager
The Life of K.D. Smith at Bell Laboratories
Edward Sharpe

Photos Credit - C. Watson, AARC

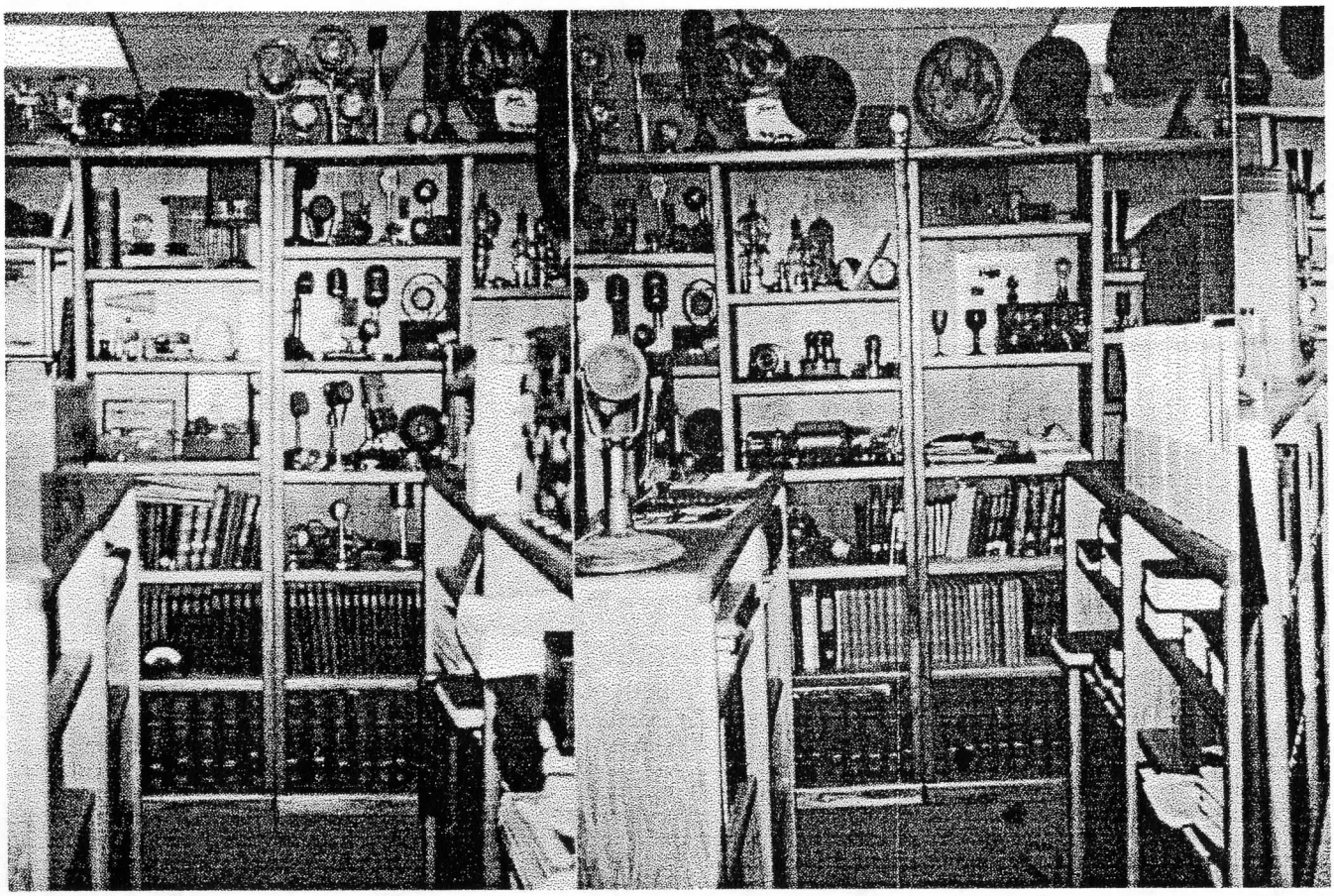
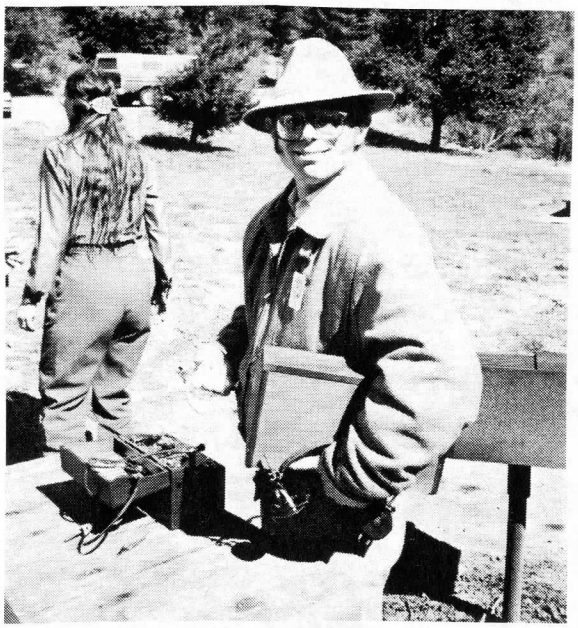
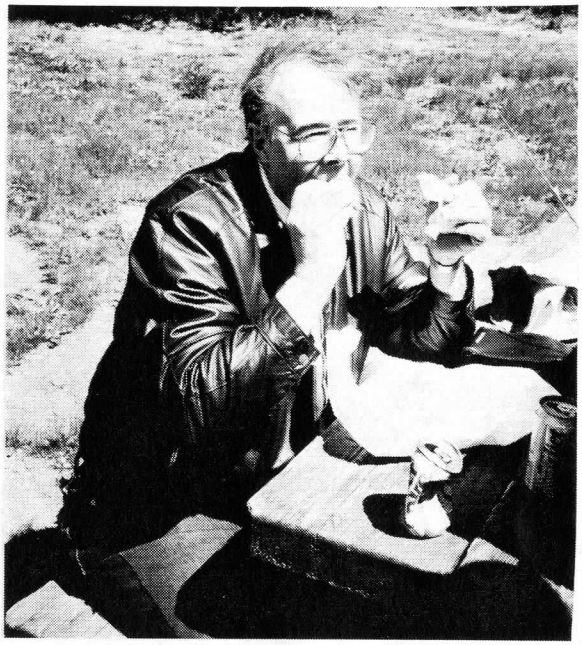
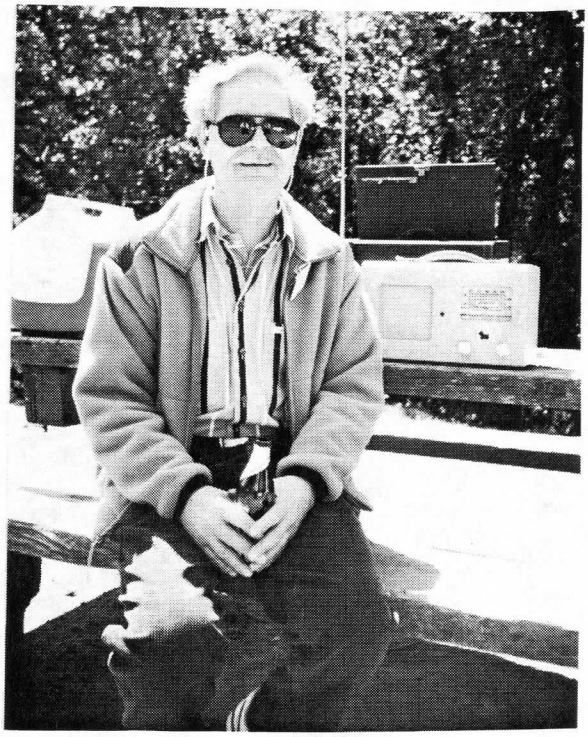


PHOTO TIME: Tilden Park Picnic







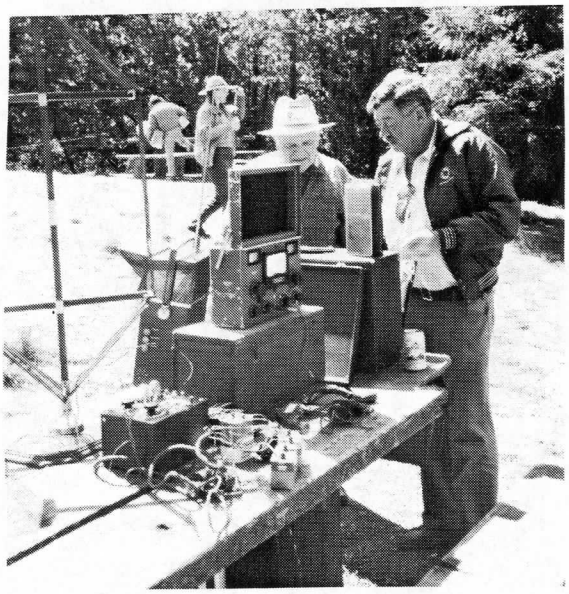


PHOTO TIME: Petaluma Swap Meet

John Bardeen, Transistor Pioneer Dies at 82 (Added since release of V.E. onDec. 1990)

Edward Sharpe: CEO of Computer Exchange and curator of SMEC.

The World Mourns The Passing Of A Great Physicist

Unfortunately, time removes all great inventors from the world. I was one of those fortunate to have shared some time with John Bardeen during the last months of his life, a memory that I will prize for the rest of my existence.

During our collaboration, John and I edited an article containing his memoirs of his early days at Bell Laboratories regarding the development of the Transistor. John Bardeen was the co-inventor of the transistor along with William Shockley and Walter Brattain.

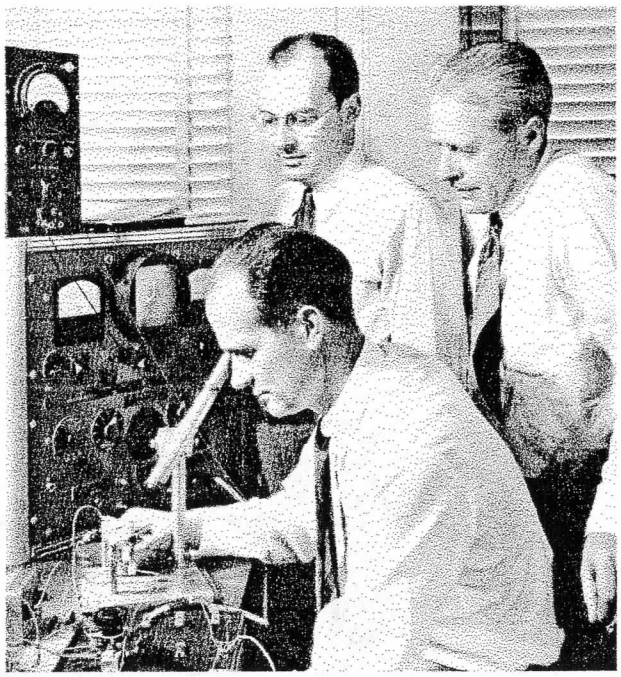
Frequent letters and phone calls were exchanged to accomplish our effort, and John had hoped to make a trip to Phoenix to view The Southwest Museum of Electricity and Communications, a museum dealing with electricity and electronics communication that is sponsored by The Computer Exchange.

This article covering the development of the Transistor was published in VINTAGE ELECTRICS, the yearly publication of the museum. The entire 92 page publication dealt with sold state technology development in the early days of it's beginning.

In one conversation, John told me that he would be submitting his manuscript in type written form. I asked if there was a chance that he could send it to me on disk, but he replied that his grandchildren used a word processor on a computer but that he did not... At that point I reminded him, that without his efforts developing the transistor we would not have small computers, he merely chuckled in a soft voice... I could indeed envision a smile of satisfaction on his face as that soft chuckle passed on the wires of the telephone line!

John Bardeen was regarded by the people at Bell Laboratories as the most brilliant of the development group that worked on the invention of the transistor. I found, through interviewing co-workers, that he was soft spoken and well liked by his peers.

The world has indeed become a better place to live thanks to his efforts and of others like him. Our existence is a bit less rich now that he has left us...



John Bardeen, standing at left; Walter Brattain to the right; and William Shockley seated at the microscope. This photo was on the cover of the Bell Laboratories Journal announcing the Transistor(1948 BTL Record)

San Jose Mercury News 1/31/91

John Bardeen, co-inventor of the transistor at made possible virtually every modern electronic device, died Jan. 30, 1991 of a heart attack.

Mr. Bardeen, 82, a two-time Noel Prize winner, died in Boston where he was consulting specialists about health problems, the University of Illinois said.

A professor emeritus and faculty member at the university since 1951, Mr. Bardeen won the Nobel prize in physics in 1956 as co-inventor of the transistor.

He won a second Nobel in 1972 for co-development of the theory of superconductivity at low temperatures.
Mr. Bardeen was the last surviving member of the three-member Bell Telephone Laboratories team that developed the transistor in 1947. Walter Brattain died in 1987 and William Shockley died in 1989.

"A giant has passed from our midst," University of Illinois Chancellor Morton Weir said. "It is a rare person whose work changes the life of every American. John's did."

The transistor replaced vacuum tubes in radios, television sets and other consumer products, as well as in computers and communication devices.

Mr. Bardeen later told a reporter, "I knew the transistor was important, but I never foresaw the revolution in electronics it would bring."

His work on the theory of low temperature superconductivity, in which electricity travels with little or no resistance, helped researchers develop such practical uses as magnetic imaging techniques for medical diagnosis.

Associates said Mr. Bardeen considered the superconductivity theory his greatest scientific achievement, although he doubted it would have the economic effect of the transistor.

After teaching at the University of Minnesota and doing research at the Naval Ordnance Laboratory in Washington, Mr. Bardeen joined the newly formed research group in solid-state physics at Bell Telephone Laboratories in Murray Hill, NJ.

He is survived by his wife, Jane; sons, James, of Seattle, and William, of Glen Ellyn, Ill.; daughter, Elizabeth Greytak of Chestnut Hill, Mass.; and six grandchildren.

San Jose Mercury News 1/31/91

John Bardeen in his later years next to a prototype of the transistor radio.

In Search of the 2 Way Conversation The Boston to Cambridgeport Test. By Edward Sharpe

During the early history and development of the telephone many notable experiments were conducted and documented. Of course, we are all familiar with that famous night at #5 Exeter Place, when Bell spilled acid on himself and those words of "Come here Mr. Watson, I want you", were spoken.

While in this process of development the world looked on as this marvelous invention, that would come to play such an important part in all of our lives, continued to take shape.

At first many people regarded the speaking telephone as merely a scientific curiosity, not as a practical device of communications. The experiment between Boston and Cambridgeport, however, was a influencing factor in changing their minds.

Alexander Graham Bell ca. 1876

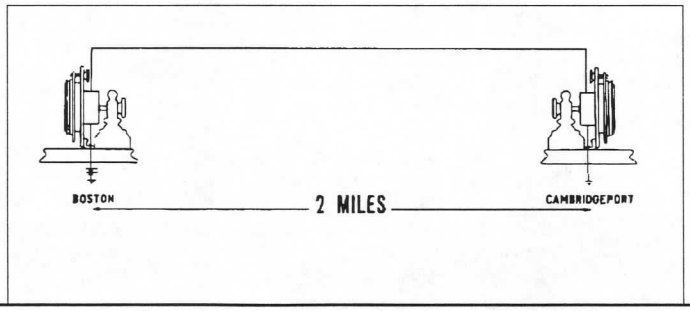
In reading through many books in the Museum, I came across quite a bit of material on the Boston to Cambridgeport test. This test took place after the Centennial Exhibition. All the conversations prior to the Boston to Cambridgeport test had all been one way, in this manner there was a speaker and a listener, each at their own end of the line.

In the evening of October 9, 1876, Thomas Watson went to the warehouse of the Walworth Manufacturing Company in Cambridgeport. He carried the telephone that was one of two that had been specifically made for this test (See photo on the next page.) along with some tools and wire, all of this wrapped up in newspaper.

Alexander Graham Bell, with an identical telephone, was at the Walworth's Boston office. The distance covered between these two points was approximately two miles.

On the previous night, these two telephones had proven their workability when tested between two rooms at #5 Exeter place.

Indeed, these telephones had passed a short range test of two way communications, but it remained to be seen if they could actually work over a greater distance than that provided inside the lab.



When Watson arrived at the warehouse he was greeted by the watchman who was in charge of the warehouse in the evening after business hours. There was a telegraph line running between the warehouse and the Boston office. Watson disconnected the telegraph instrument and connected his telephone instrument. Bell had already done this at the Boston location. Watson pressed his ear to the instrument, but alas, heard not a sound. He spent some time attempting to adjust the instrument, but still to no avail.

Images of Bell yelling into the instrument at the Boston office getting hoarser and hoarser by the moment must have been flashing through Watson's mind!

According to documentation, some of the possible causes of the failure of this experiment to work were that the insulators used on the telegraph line may not be well suited for telephone use. Another thought that entered his mind was that these particular instruments, though suitable for communications between two rooms, may have a signal too feeble for long distance transmission.

By this time the watchman was beginning to think that Watson was a bit odd, as he persisted in tweaking this odd instrument and yelling into it. I would suppose that anyone that had not seen a telephone before would doubt the sanity of a person that yells into an odd looking instrument.

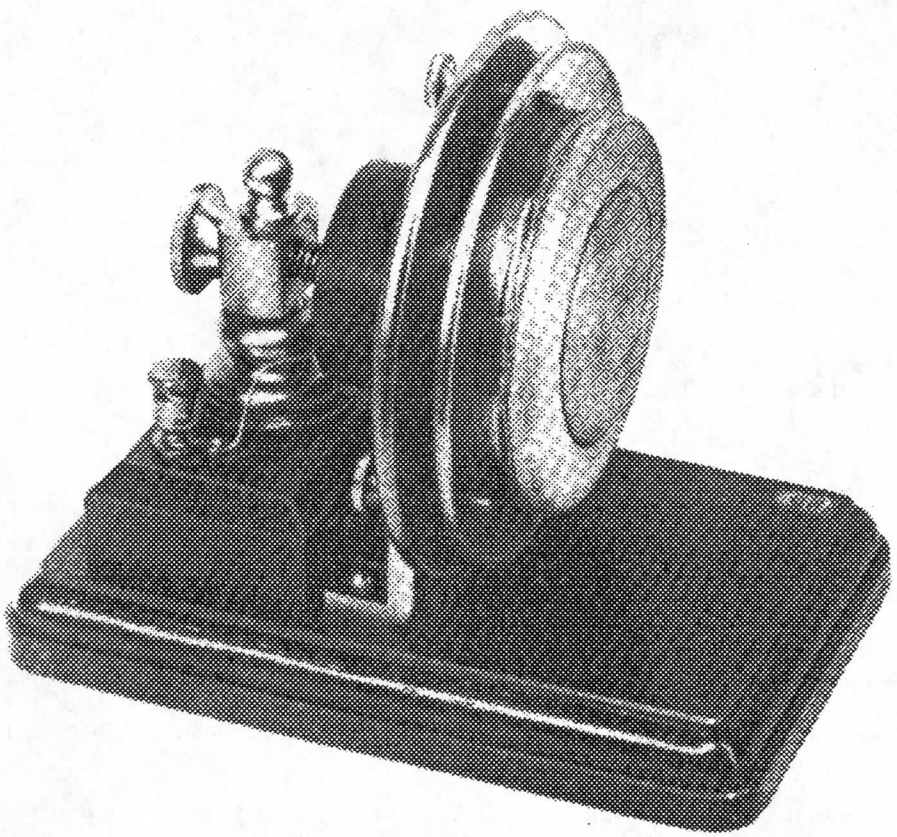
Watson was at this point feeling extremely disappointed. He had decided to disconnect the telephone and reconnect the telegraph. Before he had the chance to do this an idea popped into his head that there may be another relay in the building connected to this telegraph line, and if so, it was his reasoning that it would dampen out the small amount of signal that was required to operate the two telephones.

Watson, still being carefully scrutinized by the watchman, proceeded to trace the telegraph wire starting at where it entered the building. He came upon an office that contained the signal destroying relay that he had been searching for, and he proceeded to jumper across it with some of the wire he had brought along with him.

Rushing back to the room that contained the telephone, followed by a slow moving watchman trailing along behind him, Watson was greeted by a hoarse voice through the telephone instrument, ''Ahoy! Ahoy! Are you there?''

The conversation between the two of them continued for two hours. The primary things that were discussed were details about instrument adjustment, and testing to see if their instruments would work without the battery connected. Both Bell and Watson kept a record of what was said, and these two reportings were run side by side in the Boston Advertiser dated October 19, 1876.

Two days after the Boston to Cambridgeport experiment, Bell communicated the results to the American Academy of Arts and Sciences and exhibited to them the telephone instruments that had been employed in the test. The instruments were tested by a number of the members and Bell was congratulated on his success. -- EAS



Replica of the Aparatus used by Bell and Watson

Ed Sharpe's First Encounter With Transistors

Everyone in VINTAGE ELECTRICS wrote about their early storys about solid-state. Not to feel out of place, I have decided to tell one of my own! Enjoy!

When I was in third grade, in 1960, I had built my first radio. It was a rather simple affair using the razor blade as a detector. The blade was soon replaced by a Galena detector, probably of Philmore manufacturing pedigree. It worked well, and I was very amused that I had a radio, that not only had I built myself, but it required no batteries or wall socket current to function!

I wanted to build an amplifier to make the little radio louder, but high voltage power supplies were off limits until I was a bit older by request of, what I now see as, a wise father.

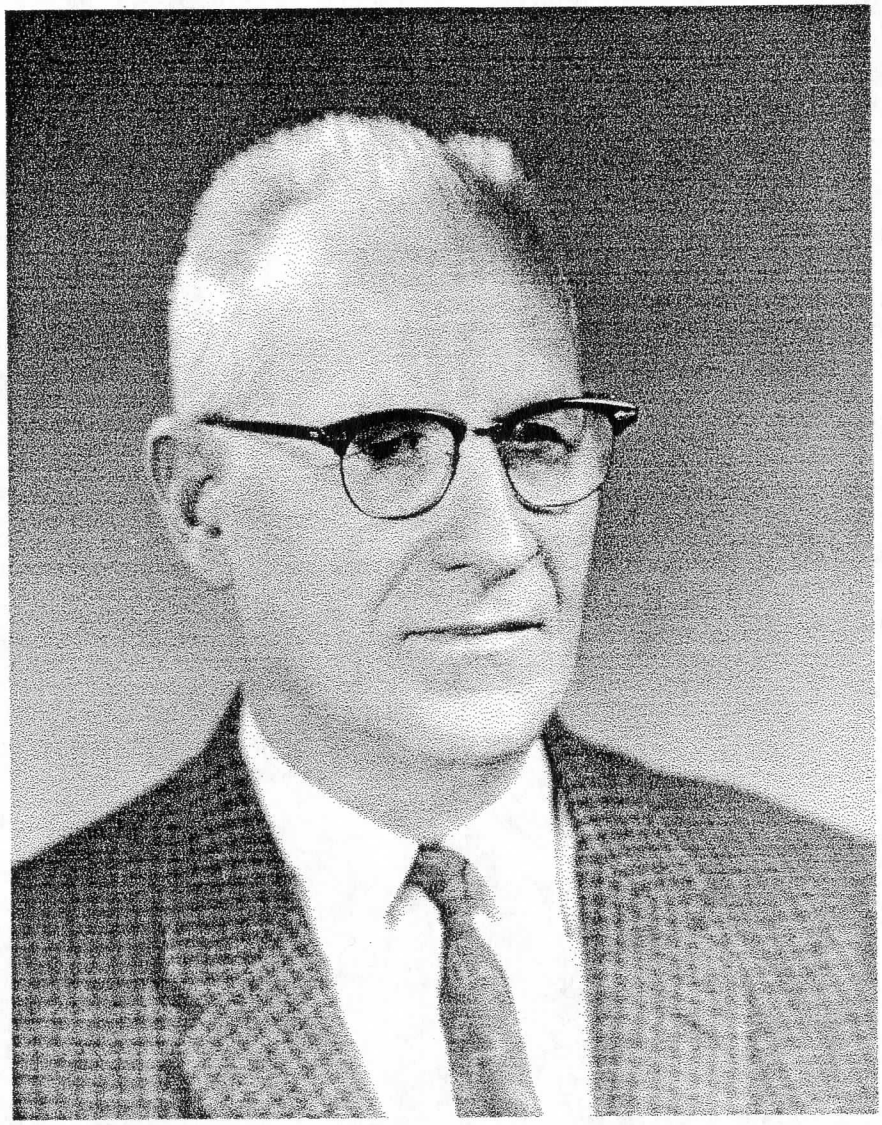
There was a girl in my class by the name of Barbara Barosa, who I liked very much! In a conversation we had one afternoon, she had told me that her father was an engineer and worked with, as she put it, 'electronics stuff'. I do not remember the exact amount of time that passed, but I do remember her bringing me in some transistors! A new world was open to me, amplification that I could hold in the palm of my hand! Of course this form of amplification could be powered by a small battery not the forbidden high voltage power supply!

I remember running from the bus clutching this handful of miracles, in a hurry to perform the implementation process on my little radio. The first connection was to replace the galena detector.

Wow! When I hooked it up a certain way I would get radio stations and I did not have to find the 'good' spot on the crystal! With a satisfied smile I decided to see if the signal could be made louder.

Into the closet I dashed to gather up the 6 large dry cells, the type with binding posts on the top, that I had stashed there. I seem to recall that I took the third lead of the transistor hooked it to one lead of this string of large dry cells and the other lead of the battery ensemble to ground. The radio stopped playing... What had happened I thought? Well.. let's try another transistor... ok new transistor in circuit.. radio works.. connect battery... transistor is dead... next one the same result.... I think you have the picture now! Right? I was of course managing to destroy my new found amplifiers one at a time. My new found solid state toys grew quite warm when the current from these 6 dry cells flowed through it!

I took the remaining couple of transistors that had not undergone the 'test' and placed them on the dresser top to await my dad's return from work. My father, although I realized he was knowledgeable in electronics, had not built anything utilizing transistors. In talking with him that evening I learned his experience with actually doing engineering work was prior to the transistor era. He had spent his recent years at Hughes Aircraft in management. He was in the years to come, however, teach me many things about electronics, microwaves, how to work on mechanical things and life in general. - EAS



In Memorium... Kenneth D. Smith
1905 - 1990

We at the museum regret the passing of Kenneth D. Smith. He was one of the people who made a difference in advancing the technology on which the world has come so much to depend. K.D., as his friends called him, worked his entire life at Bell Laboratories. He was involved with projects ranging from Proximity Fuses and Radar during World War II, the TD-2 trans-continental microwave relay system and early development work on transistors. In addition to transistors, K.D. was involved in the Bell Solar Battery project, both in the 1950's, as well as working on the solar cells that went up on Telstar. Other areas that K.D. was able to explore during his employ were high frequency transistors, power transistors, varistors, rectifiers and many other solid state components. He also made an unusual contribution in that he preserved many experimental and development model semiconductor devices and publications from the late 1940's thru the 1960's. These items are the core of The K.D. Smith Collection.

Besides being an excellent innovator, K.D. Smith was an excellent human being. Of all of the people I have spoken to about K.D., not a single person had one bad thing to say about him. In the following pages you will learn what K.D. was involved with, as well as getting a picture how his part fit into the entire technological scheme of things. In VINTAGE ELECTRICS Vol. #2 , you will be able to read what some of his co-workers thought of K.D. Smith. Mr. Smith will be missed by his family, his friends, and those who were not fortunate to meet him. - EAS

The K.D. Smith Collection.

By Edward A. Sharpe Archivist, Southwest Museum Of Electricity and Communications

Introduction.

K.D. Smith, while in the employ of Bell Telephone Laboratories as a staff engineer, had access to what seemed to be an unlimited supply of early experimental examples of solid state technology. Apparently when something was to be disposed of, K.D. would collect it up and save it. When I asked Jim Early, a colleague of K.D. Smith, if he or anyone else had managed to save any of similar material as K.D. Smith had, he told me no, that K.D. was the only one that had made an effort to collect up some of it.

Although the folks that sorted through the immense collection of old radio tubes, transistors, and assorted items assumed that K.D was mearly a pack rat; it has become a proven fact that things were saved for a purpose once you analyze the material at hand and reviewed the reference material published by The Bell System. Within seconds I recognized the artifacts at hand as being historically significant, and within just hours realized why many of the items had been saved.

One reference source that serves as a extremely valuable resource are the lab notebooks full of comments that K.D. Smith kept at home. Many times the information was a duplicate of what he put in the formal notebooks that Bell Labs required employees to keep that would be witnessed to support patent cases. Often though, the thoughts he would jot down were just things that came to mind and he wanted to keep a record of.

Some of the most enjoyable reading in his journals are the records of what K.D. called ''PARTLY BAKED IDEAS'', which he often referred to in an abbreviated form as ''PBI's''. they were either brief introductions to a possible invention, or in many cases just a record of a possible way to solve a problem that was at hand.

There were times that were noted in the books that he became rather frustrated in maintaining order in this large collection of artifacts, and at one point on the vacuum tubes, he allowed himself to keep only a maximum of 10 of each type! When it came to early solid-state devices however, 'THE MAXIMUM OF TEN RULE' Did not seem to apply! If one was to judge the fondness for a development project, based on the amount of artifacts that were kept, the clear winners would have to be M-1752 junction transistors and Bell Solar Batteries (solar cells).

K.D. made other references in these notebooks that the material needed to be sorted and categorized. Apparently some of this action was carried out, as you would find some of the most profound artifacts in shoe boxes marked 'MUSEUM'! Envelopes that were in these shoe boxes had transistors grouped together in them. Many of the envelopes were the original filing envelopes that the devices had lived within all of there lives accompanied by the measurement data on the part. This data was very instrumental when Howard Dicken wanted to see how the parameters had changed in the time since the device's date of manufacture (see the article on this subject by Howard in Volume #2 of VINTAGE ELECTRICS).

In one document that is among K.D.'s notes from the early days, this list provides some great insight as to what K.D. felt were historical or landmark devices. In reviewing this list I whole heartily agree with his selection. At the time the technology was new he had fantastic foresight as to what we would be excited about this many years later!

I wish I had K.D. Smith sitting next to me to explain what some of the items that he had in his collection were, the stories behind them, what had led the developers to the point that the device represented, and to explain to me just what some of the items are! In any collection of artifacts, the person that does the collecting always has the greatest insight on the artifact itself.

K.D. Smith is to be commended for his collecting efforts. Had he not collected in such a large scale manner, the world would be without many examples of the early solid state technology. Although the Bell Patent Department has examples of each M series part, we are not sure that they possess the variations that we have come across here.

Fortunately I have made a number of fine new friends out there that worked with K.D. back during the glory days of transistor development at Bell Laboratories. I can not express enough gratitude for the patience and insight afforded this thankful archivist by Jim Early and Bob Ryder. Without the help of these two associates of K.D. Smith's I would have been traveling uncharted waters without guidance.

Many long hours of discussion and teaching were done by existing friends, namely Morgan McMahon, Jack Sadler and Howard Dicken. You will also see articles by these fine scholars here also in this publication! Yes, I had used transistors since third grade, but had never learned the history of the development, processes involved in manufacture or how the companies were born and died. I have all of these folks to thank!

How the collection came to the museum.

K.D. Smith had passed away and the Smith family contacted Clem Chase, a radio amateur and also at that time president of The Quarter Century Wireless Association, to help the Smith family dispose of some radio equipment.

What Clem thought would be the contents that would fill just a couple of boxes, turned out to be an entire truck load of the wildest assortment of parts and equipment that Clem had seen!

Clem Chase at this point enlisted the help of two other radio amateurs and fellow members of QCWA, Harry Snyder and Gerry Higgins, from Carefree Arizona. Clem drove the truckload of goodies up from Tucson, where they were deposited on Gerry Higgins garage floor to be sorted. The truckload, when spread out took a good part of Gerry's garage space! The sorting process took 3 days, being primarly done in the morning, due to the extreme heat we are endowded with in the summer here in Arizona.

The collection at this point consisted of radio tubes, transistors of what appeared to be of an early nature, books, circuit boards, hardware, scraps of wire, old transformers, odd brass looking objects, scrap metal and amateur equipment. There were also thousands of short lead components suitable for insertion into PC boards that K.D. had kept for future project use.

It seemed most odd that there were only a small grouping of books. Usually in our experience, anyone that has this much equipment and parts also has a vast quality of books magazines and papers! Harry told me that was all that they had seen in the batch, and offered no explanation as to why there were so few.

After I had sat for an hour and read through the books, I noticed that they all contained articles by K.D. Smith. It was clear at that point that K.D. had been one of the pioneers in the early Bell Laboratories transistor efforts.

I then called all of the people that I knew! I wanted to know if they had heard of K.D. Smith, and what these folks knew about early transistor history.

I found that I had an excellent reference library sitting right next to me in the form of BELL SYSTEM TECHNICAL JOURNALS and The Bell Laboratories RECORD. In the pages of these fine journals, the history of the Bell Telephone Laboratories progress is contained!

I also called K.D.'s son Dave Smith, and Dave sent us many papers and notes that K.D. had saved during his time at Bell Laboratories.

Discovery of the Morton tube.

I had seen pictures of the Western Electric 416 tube prior to my encounter with this collection, so when I saw what appeared to be a 416, I was able to recognize it instantly. In my further searches through the collection I found what looked to be a crude 416 tube. It had many of the same aspects as the 416, but instead of having the nicely gold plated pins comming out of the bottom of it, there were wires protruding from the base acting as the connection! The more I inspected the tube, the cruder it looked! Yes! You guessed it! This was one of the early prototypes of the famious 416 triode, or as it is known by Bell Laboratories folks I know, as ''The Jack Morton Tube''.

This tube was the heart of the trans-contental microwave communications network called the TD-2. This system, although not known to all of us by name, nevertheless, has been a part of our lives for a long time. The TD-2 carried , in the days before satelites, all of the cross country TV network programming, as well as long distance phone calls.

At this point I contacted Bob Ryder, a former Bell Laboratories employee, and friend of K.D. Smith. In addition Morgan McMahon introduced me to Jim Early. Both of these fine folks were very helpful in educating me as to what was here in the collection.

I also called John Bardeen, inventor of the transistor. He did not know K.D. Smith very well, as he had left Bell Laboratories in 1951 to teach at the University of Ill. John did, however, send us an early transistor and spec sheet that he had been sent after the 1952 teachers meeting at the Laboratories (see article, teachers taught about transistors in this issue).

I finally met Dave Smith in person at the 75 Ave off-ramp and Interstate 10. He was going back to Santa Barbara, and had found a batch of interesting papers of K.D.'s for us at the museum. We were actually supposed to meet at 67 Ave and the interstate near a three story hotel that LeeAnn told us was there. However I guess we both got there and there was no hotel at 67 Ave and the freeway!! We both called LeeAnn for help, my call was first and I told Leeann that I would be at a Circle K at the intersection of 67 and McDowell, just north of the freeway. I cruised around awhile and called again. The line was busy so I called the other line and she said Dave was on the line and she had passed the info to him as to where to meet! I went on down the road and ended up at the Circle K just as Dave was pulling up.

After a greeting session, Dave showed me a few of the contents of the box he had brought up from Tucson for us. Unknown to either of us, there was a policeman watching both of us, and he came up and asked what we were selling. I guess, looking back on it, that we must have appeared rather odd with cars from two states and our greeting and exchange of old cardboard boxes!

WHAT DOES THE COLLECTION CONSIST OF?

In the future displays of the K.D. Smith Collection at the Southwest Museum of Electricity and Communications you will find many items of interest. Among these but not limited to, are the following list of areas to give you a brief introduction and wet your appetite!

- The K.D. SMITH MEMORIAL -

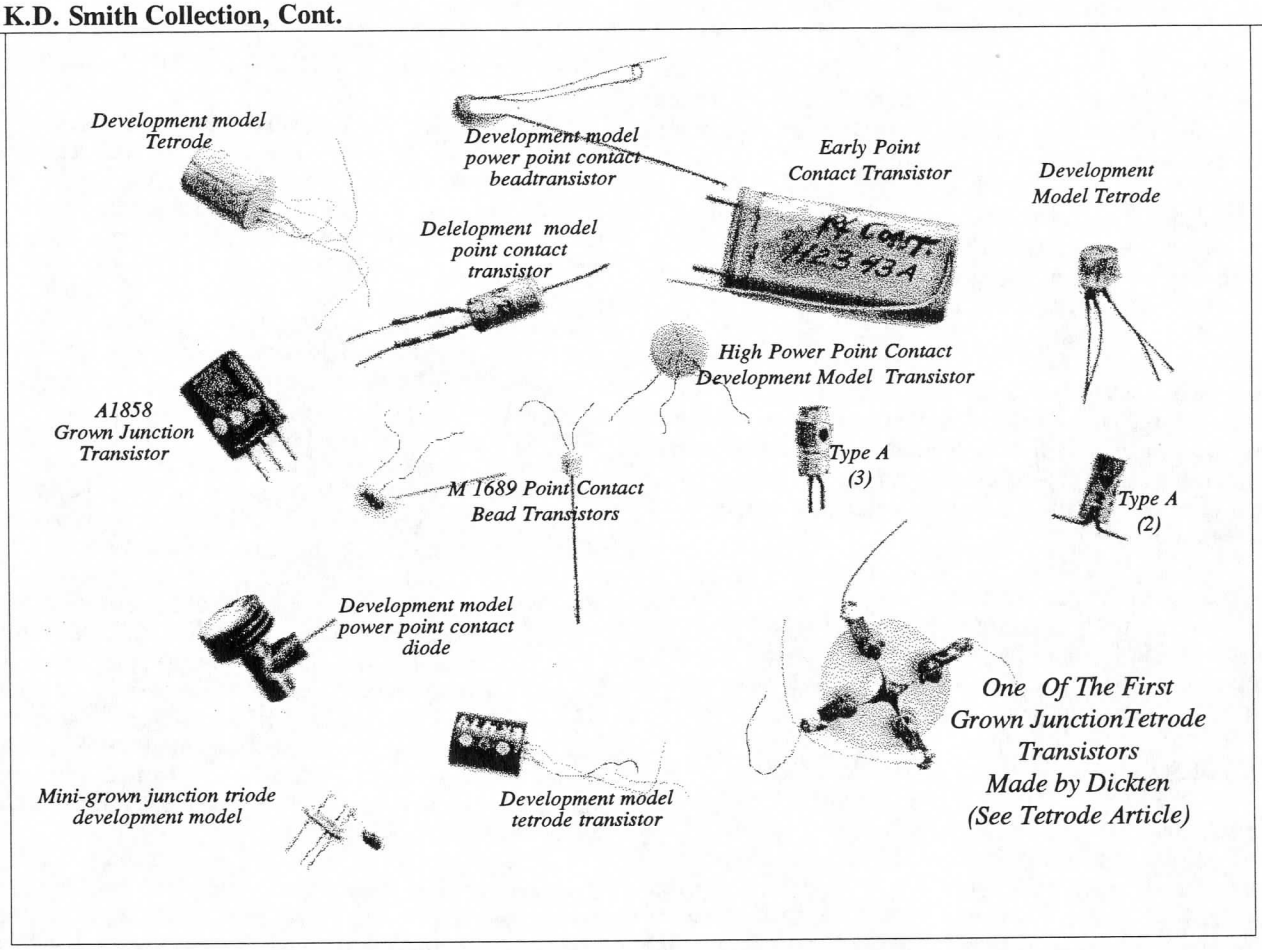
This display shows pictures of K.D. Smith at various ages. In addition there are photos of him working on various projects at Bell Laboratories. You will also note the listing of all of the projects that he had involvement with during his 40 years at Bell Laboratories. In addition to his ability to collect artifacts from the eaa that he existed in, K.D. was a very productive engineer and had the ability to work on very diverse projects.

- BOOKS ON SOLID STATE -

Early books published by Bell Laboratories on solid state. These are also supplemented by books given to us by Jim Early, Bob Ryder and Morgan McMahon. In addition to all of this, the semiconductor library is supplemented by the museum's collection of BELL LABORATORIES RECORD and BELL SYSTEM TECHNICAL JOURNALS, that have been here for reference here for quite a while.

- BELL TELEPHONE LABORATORIES NOTES -

There is large collection of preliminary sketches of devices made before they were actually produced. Included also are rough drafts of papers that K.D. presented at conferences. The rough drafts of letters he made to fellow workers and



supervisors show some of the problems that were experienced during device development, and what was done to work out the problems.

One of the more fascinating aspect of this paper collection are the Status Reports, Memorandum For Record, and Technical Memorandums that were issued during the progress of the development of a device. The content of these items cover cost estimates of material and capital equipment for manufacturing and estimates of quality to be produced and the time frame to accomplish it in.

The distribution list on the last page of the above mentioned of reports reads like a Who's Who of the early semiconductor pioneering effort! Even these distribution lists provide insight, as each project would have certain of the engineers and scientists involved with it. The distribution list tells you which of them was playing a part in the project!

- THE OVERVIEW -

There is also a display showing some of the various types of solid state devices that Bell Laboratories developed that were part of K.D. Smith's preservation efforts. It will give you an overview of diodes, transistors, varistors, thermistors and solar cells.

- INSIDE THE TRANSISTOR -

Besides the devices themselves, there are small displays that were built by Bell Laboratories that show the manufacturing process that the device progressed through, each display is like a exploded view of a component, but implemented in actual parts rather than just a drawing! Feel free to use the magnifier hanging next to the display to examine Point Contact, Grown Junction, Alloy, Difused Base and other types of transistors that are on display!

- THE BELL SOLAR BATTERY -

Many different forms of solar cells and some historical examples are displayed. These solar cells were called BELL SOLAR BATTERIES, and there are examples as they developed from crude prototypes into the more advanced form that was used on satellites.

Historical samples include one of the arrays that was made up for the first transistorized repeater experiment that took place high atop a telephone pole in Georgia in 1958. These are the early design P on N Bell Solar Batteries. A variant of the cells that were in this array can be seen encapsulated into a solid block of plastic. There are three cells in this block, and this artifact was used in the late 1950's as a lecture aid by Bell Laboratories staff.

The final historical grouping are examples of bell solar batteries that were slated for the TELSTAR I project. These were the brothers of the actual cells that went up on the satellite, but alas even though made from some of the same silicon crystals as their brothers, they did not pass the rugged tests that constituted the selection process. Some went up to generate power for the first television relay via satellite, and some remained earthbound to be collected by K.D. Smith and to arrive here at the museum for your viewing enjoyment!

Most of these cells work and output a half a volt each, however, there may be discoloration to the surface, or did not produce the desired current, or worst case - there are some dead ones also!

We have also included as many pictures in the display as we can, so that you might see what these components actually looked like when their brothers were producing power in examples of amplifying telephone calls to powering TEL-STAR I!

These solar cells were quite a bit different from their predecessors. Not only are rectangular rather than round, but these cells are made with N on P structure to avoid depletion of minority carriers. To armor them up for their cosmic experience, each cell is coated on the outer layer with synthetic sapphire.

There is one of the Bell Solar Batteries out of the TELSTAR batch hooked up to a meter so you will be able to see it functioning. It is rather fun to pass your hand in front of it and watch the deviation of the meter as the light striking it's surface is diminished by the shadow your hand causes.

- DIODES -

Diodes! Some of these date from Before the WW-2 era. This was the solid-state effort that Bell Telephone Laboratories was involved in prior to the invention of the transistor. Even after the invention of the transistor there was much research being done on diodes also. Such items that are on display that came out of that effort are the IMPATT Diode, Varactors, improved Varistors, PIN diodes and more! Those amazing diodes.... not just a crystal detector once the BTL folks started working on them!

- TRANSISTORS -

There is a great type collection of transistors arranged in chronological order by M and A series numbers that Bell Laboratories assigned to projects at their inception. There are transistors here that the only place they were truly seen was inside the lab itself, as many never made it past the experimental stage!

Remember, Bell Telephone Laboratories developed transistors, Western Electric made them, and the Bell operating companies consumed them. Although Bell Laboratories was with out a doubt the leader in solid state development, they, nor did their brother companies really sell transistors to the end users. They did, however, license the manufacturing processes and the technology they invented to other companies. These companies Such as TI, RCA, GE, HUGHES and others would build for the end user customer.

There were exceptions to this practice of internal consumption though. Western Electric did have a lot of government contracts. These contracts consisted of radar, microwave relay, missile guidance systems, and communications packages to go into government and NASA satellites.

WHO'S NEEDS DOES THE COLLECTION ADDRESS?

This collection of early Bell solid state devices, outside of visiting the Bell Patent Department, is the most complete type collection of it's type in the country. In addition to the devices there are examples of the literature, manufacturing tools, and parts that were used to make up the various solid state devices.

Students that are studying semiconductor manufacture can actually see how the early devices were assembled. There are samples of the actual germanium and silicon grown crystals that they can study. The process continues with slices from the grown crystal and on to the bar itself that would have leads attached to it. The most complete manufacturing sample file is associated with the M1752 grown junction germanium transistor, the very one that K.D. spent quite a bit of his time helping develop.

The library offers to anyone an outstanding collection of the birth of the era of solid state. It is a relatively small section of the museum's library due to the fact that not much literature was published prior to 1952 on solid state. In era following 1952 the quality of books almost seems to blossom! We have folks like Morgan McMahon, Bob Ryder, Jim Early and John Fairfield to thank for their submittal of many of these. we are always looking for more to supplement this section.

The person who is in management may want to study some of the yield figures that we have for the early devices. statistical information is available in the form of Bell Laboratories status reports that outline exactly what state the project was at the time of the report being issued.

The beginning student in the electronics field its treated to artifacts that show solid state in it's infancy and simplistic form. The displays in which transistors are shown in their assembly stages serve to de-mystify what exists within the sealed can they are learning to build and design with. Of course, the early literature acquaints them with the historical development of solid state. This is a chance to be exposed to many things that are not possible within a classroom envioronment!

Diodes - Transistors, the solid state components in integrated circuits. For a student to fully realize the impact of what he will be designing now, it is important to study how the devices that proceeded his impacted the world around him. All of this information is at his fingertips.

To the person doing historical research, the K.D. Smith Collection is a vast asset, the researcher not only has actual hardware artifacts but the printed material to draw upon. The museum functions as a centralized reference resource not only covering the early days of solid state, but also embraces electrical and communications technology dating back to the very earliest inception of the technology itself. -EAS

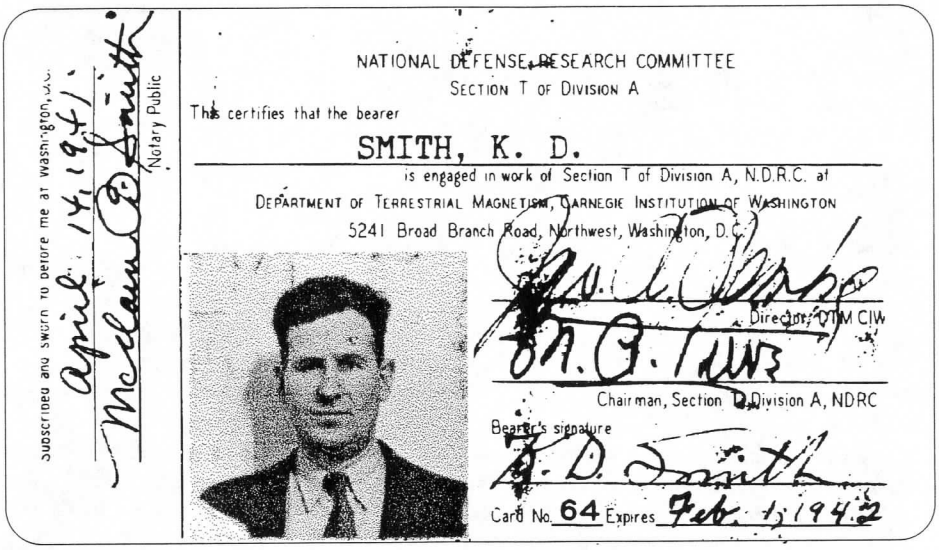
RESEARCH CONTINUES ON THE MANY ITEMS THAT K.D. SMITH COLLECTED!

The Life Of K. D. Smith At Bell Laboratories By Edward A. Sharpe

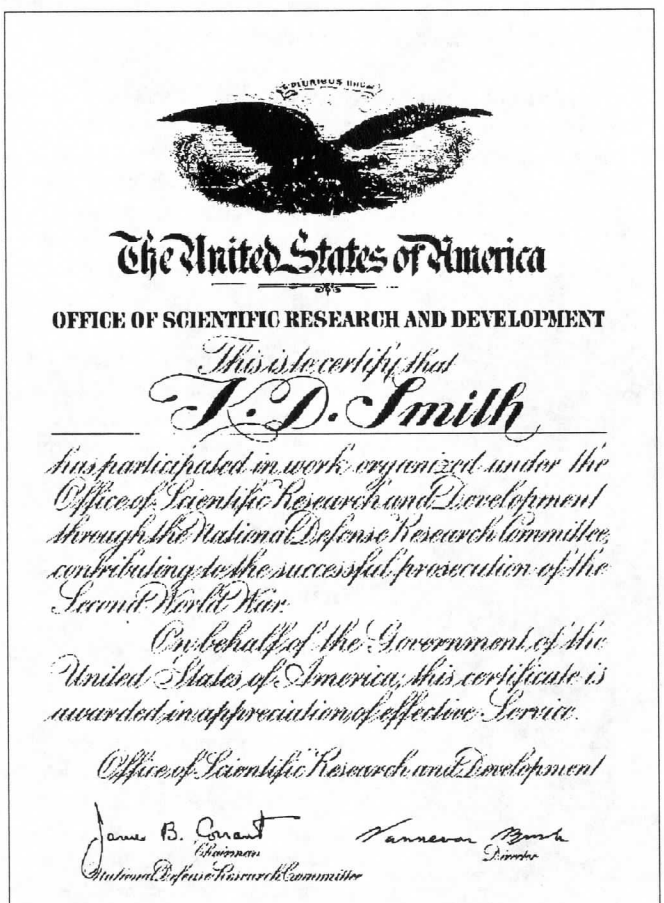
1930-1940

K.D. Smith was involved with the development of test methods and electronic test equipment relating to carrier systems, coaxial cable terminals and field tests.

We are fortunate to have large notebook that K. D. Smith saved with some of the memorandums he authored and co-authored. The first of these is dated Oct. 1, 1931, created by K.D. soon after his arrival at Bell Laboratories (remember, he started in 1930), it is entitled ''Dynamic Cutoff of Vacuum Tubes''. The last in this notebook is dated Mar. 23, 1936; and contains a review of the Boonton Radio Corporation 'Q METER'.



This notebook gives some insight as to what K. D. Smith was involved with, but presents only a partial picture by itself. However when you couple it with the Bell Laboratories RECORD magazine, and the BELL SYSTEM TECHNICAL JOURNAL issues that we have in the museum, we will be able to portray a more complete picture... With a bit more research.



1941-1944

America went to war during this segment of K. D. Smith's career. During this epoch he was involved with the development of proximity fuses on behalf of Division 4, National Defense Research Committee. In fact, he was a consultant to the NDRC from 1941 until 1943.

Since this was a extremely classified project, he did not collect much in the way of artifacts or written material to take home during this time.

Seen here in VINTAGE ELECTRICS, along with this article is a picture of K. D. Smith's NRDC ID card. At the end of World War II K.D. Smith was presented with an award from Office of Scientific Research and Development through the NDRC for ''Contributing To The Successful Prosecution Of The Second World War. A much reduced copy of this certificate is shown here, as well as a full size version of this document on file in the museum.

1944-1945

Radar - our nation's eyes to protect us against from the unseen enemy forces and to guide our bombs to their precise targets through the darkness of night!

K.D. Smith was working on the development of RADAR at Bell Laboratories during these years, and in 1945. One of his notes references that he was project engineer on the AN/APQ 13 and the AN/APQ 23.

For the person wishing to do research on the World War II RADAR efforts at Bell Laboratories, they will wish to consult the BELL SYSTEM TECHNICAL JOURNAL which in the late 1940's contains many in depth articles and pictures that show and explain the Bell System's involvement with the development and manufacture of RADAR equipment.

1946-1947

K.D. Smith was project engineer on the TE-1 and TE-2 short haul microwave relay system intended for Television studio to transmitter site service; and for repeatered routes of 2 to 3 links. The TE-1 system operated between 3.7 and 4.2 Gigahertz.

An excellent explanation of this system can be found in a publication entitled ''A New Microwave Television System'' that K.D. Smith co-authored with J.F. Wentz. This talk was presented at the winter meeting of the AIEE in January 1947, and the paper was printed in the Transactions for the AIEE Volume 66, pages 465-470 in 1947.

For an in depth look at what it was like to set up the first test between Hollywood and Mount Wilson, we have on file K.D. Smith's Field notes of this event. It chronicles the events from un-boxing the equipment through the successes and problems that were encountered!

1948-1951

K.D. Smith was the circuit design supervisor on the TD-2 Microwave Radio Relay System. The TD-2 was the backbone trans-continental microwave relay system carrying network television programming as well as long distance telephone traffic. Long before communications satellites were a practical reality, the TD-2 system was what brought us the television shows we so much enjoyed from the network studios in New York, and gave us enough long distance telephone connections to talk to Aunt Martha back on the Eastern seaboard during Christmas day!

K.D. Smith's specific responsibility was the F.M. terminal systems used in the TD-2. The F.M. terminal converted video signals to a 70 MHz frequency modulated signal that modulated the microwave transmitter circuit that generated the output signal of the microwave relay link.

Excellent reference on the TD-2 system can be found in ''The TD-2 Microwave Radio Relay System'' by A.A. Roetken, K.D. Smith and R.W. Friis. This article was published in the BELL SYSTEM TECHNICAL JOURNAL, Volume 30 (part 2) Pages 1041-1077 on October 1951.

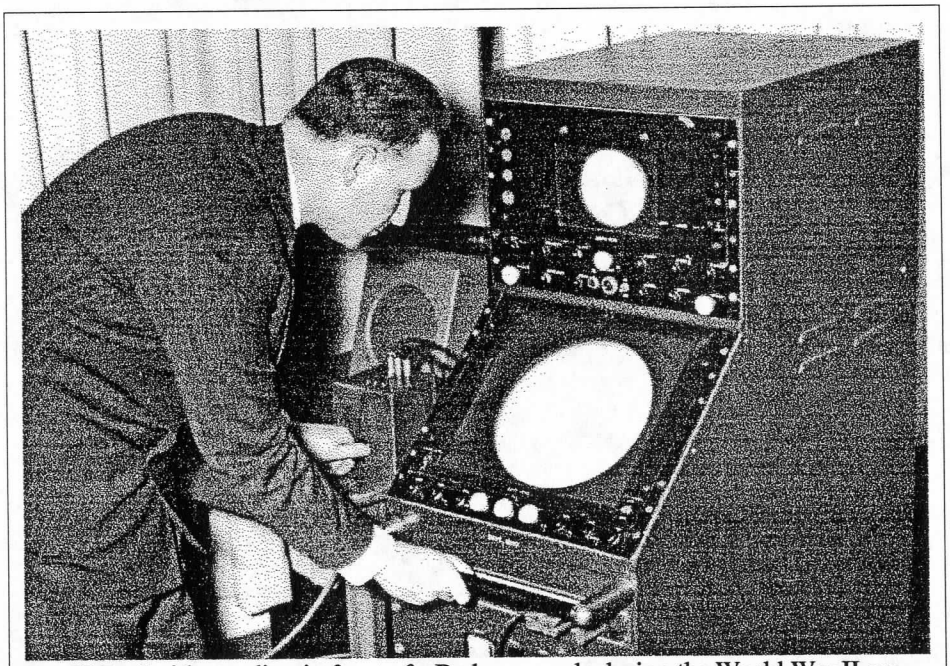
An interesting side light is that this publication was one of the three selected from the BELL SYSTEM TECHNICAL JOURNAL to be preserved until the year 6939 AD, in the Westinghouse TIME CAPSULE II. This time capsule contains a panorama of what was then current human activities. The capsule was buried alongside TIME CAPSULE I. Both capsules reside under ground at the site of the two New York world's fair. TIME CAPSULE I was buried in 1938 and the second was buried in 1965. This historic time capsule is discussed in ''BELL LABS NEWS, May 15 1965. This newsletter as well as the publication on TD-2 that K.D. Smith co-authored is on file at the museum.

Another excellent reference on the TD-2 system is contained in ''THE TD-2 STORY'' a book that was authored by A.C. Dickieson, and presented to the museum by him. Both publications, as well as the time capsule story in the BELL LABS NEWS present an excellent view of the TD-2 system for the person with the curious mind!

The TD-2 system and it's steel and concrete towers was a communications marvel! It deserves a large article here in VINTAGE ELECTRICS in the near future.

Rumor whispers the demise of the TD-2 system, as widespread use of communications satellites is now a reality in our everyday existence. The large ''wide bandwith'' fiber optic networks that have been created also supplement the satellites for long distance communication involving television transmission and long distance telephone calls.

TD-2 indeed enriched our lives, and let us take a moment to thank K.D.Smith and all the other developers that made this communications marvel possible.

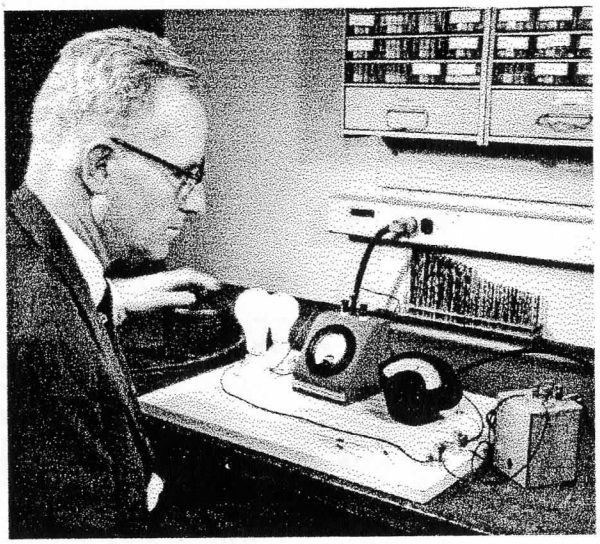


K.D. Smith standing in front of a Radar console during the World War II era.

1951-1952

With experience with vacuum tubes since 1930, K.D. Smith was thrust into the future world of solid state in 1951!

After the invention of the point contact transistor by Bell Laboratories credited to Dr.'s Brattain, Bardeen and Shockley, one segment of the device development engineering staff set out to perfect



K.D. Smith Showing how diodes protect meters. This photo was used in his article in ELECTRONICS in 1957. The month of this issue is at present not known.

the NPN grown junction transistor. In the earliest point in the life of this device, it had been theorized by William Shockley, and a working example built by Morgan Sparks and Gorden Teal. The job left up to the engineering staff was to make it reliable, increase the frequency performance and provide it in a small packaged form. This effort resulted in the creation of a development device that was coded M-1752.

The M-1752 pioneered the way for many other forms of grown junction transistors to follow. K.D and the others that made up the engineering staff created improved versions that were at the same 50 mW power handling level as the M-1752 as well as higher power handling devices as well. The Grown junction triode was to lead to R.L. Wallace's grown junction tetrode, which led to high reliability and bandwith in reference to the time frame it was created in.

All of these devices, except the Sparks and Teal Prototype are on display in the museum for your viewing pleasure! You are able to see how the device was built, as well as seeing grown junction devices from the crude prototype stage to the production models that were used by The Bell System to make our lives more reliable.

During the time that K.D. Smith worked on the development and refinement of the Grown Junction Transistor he published the following works that document the efforts put forth on this device at the Laboratories at that time.

1. Properties of Grown Junction Transistors
National Electronics Conference, where it was presented as a paper and also was published in the proceedings in October 1952. This paper also appeared in print in TELE-TECH magazine January 12, 1953.

2. Surge Limitations of Junction Transistors: This was an unpublished paper presented at the IRE Semiconductor Research Conference June 1953.

3. Grown Junction Transistor Development: Published in the Bell Telephone Laboratories RECORD magazine October 1955. This article is reprinted in VINTAGE ELECTRICS Vol. #2, and provides a very easy-to-understand explanation of how a grown junction transistor works, and also how one of these devices is fabricated. This is really some great reading, not only for the beginner, but for the seasoned professional as well. The article covers background on the M-1752 as well as later production types used by the Bell System in production style telephone equipment. Although this article is not of the 1951-1952 time period covered in this section, it shows that K.D. Smith continued to keep in touch with the progress of any device or technology that he was once involved with. At In 1955 he was currently involved with silicon devices that will be covered in the next section.

Aside from these formal presentations and papers, K.D. Smith enjoyed sharing his knowledge and technology at smaller meetings at colleges and electronics special interest group meetings.

Chapter 12.2 and Chapter 23.1-23.1 Bell Telephone Laboratories series of books entitled TRANSISTOR TECHNOLOGY: These chapters relate to the material evaluation and parameter measurement of transistors. A copy of this is available in the museums research library.

1952-1956

Being a project engineer was nothing new to K.D. Smith, but during these years he was to explore the new domain of silicon semiconductors, such as the Bell Solar Battery, large power rectifiers, Voltage Limiters and power transistors. The reader will find more information on Bell Solar Batteries by reading further into VINTAGE ELECTRICS Vol. #2.

During this exploration of the technology he presented or published the following papers:

''Properties and Applications of Diffused Junction Silicon Rectifiers'' PGED Washington Conference 1955.

''Economical Diffused Junction Varistors'' PGED Washington Conference 1956

''Silicon Diffused Junction Avalanche Diodes'' Journal of Electrochemical Society, page 104 April 1957. This paper was also published in the Bell Laboratories TRANSISTOR TECHNOLOGY series, chapter 8b.

Silicon Diodes Protect Meters published in ELECTRONICS (Month not known) 1957.

It appears he was still interested in his old project area involving grown junction transistors, as he published a paper in 1955 relating to improvements in this area. See the 1951-1952 project coverage before this chapter.

1956-Retirement

K.D. Smith continued his work on The Bell Solar Battery, in the form of solar cells that were to ride up into space with both Telstar's I and II communication satellites.

In a letter to J.M Early during this development effort and after Telstar I had been launched, K.D. Smith presented some ideas on why the solar cells output was far more diminished that what had been expected by the proton fluxes in the van Allan radiation belt and the high altitude atomic tests that had preceded the launch of Telstar I. This letter that is on file at the museum, is entitled ''Micrometorites And Damage To Bare Solar Cells In Earth Space Orbits'' it is dated April 1963.

This data was forwarded to NASA and the suggestions that K.D. Smith provided in this report are a part of every space borne solar power plant that has been launched since then.

During this period K.D. Smith co-authored a paper along with F.M. Smits and W.L. Brown titled ''SOLAR CELLS FOR COMMUNICATION SATELLITES IN THE VAN ALLEN BELT'' This paper was presented at the British IRE convention in Oxford England July 1961, and is of course on file at the museum.

The Later Years.

K.D. Smith was to spend much time on the development of diode and transistors that would work at high frequency. We plan to cover this in detail in the next issue of VINTAGE ELECTRICS, as the area is very large.

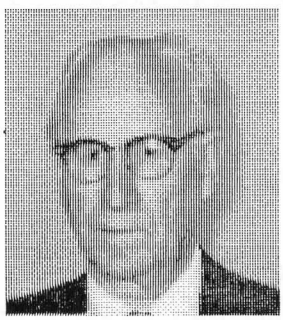
Some of the publications at this time were:

"Generating Power At Gigahertz With Avalanche Transit Time Diodes" In ELECTRONICS, August 8,1966.

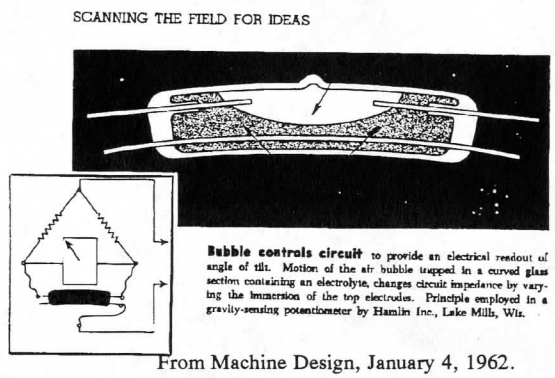
"The IMPATT Diode, A Solid State Microwave Generator" Bell Laboratories RECORD, May 1967, pages 144-148.

K.D.'s time during his later years at the laboratories are not as well documented as the early years were, so research is still underway in this area.

Be sure to read future issues of VINTAGE ELECTRICS to learn more of the work of K.D. Smith.



Picture of K.D. Smith from his retired Bell Telephone Laboratories I.D. card. This is thae last photo that we have that was taken of K.D. I would assume it was done in the late 1980's



SCANNING THE FIELD FOR IDEAS

Bubble controls circuit to provide an electrical readout of angle of tilt. Motion of the air bubble trapped in a curved glass section containing an electrolyte, changes circuit impedance by varying the immersion of the top electrodes. Principle employed in a gravity-sensing potentiometer by Hamlin Inc., Lake Mills, Wis.

From Machine Design, January 4, 1962.

Mixed rollers reciprocate rods in a forging machine. As the alternate solid pairs of cutaway rollers permit return springs to force two rods away from the center of the

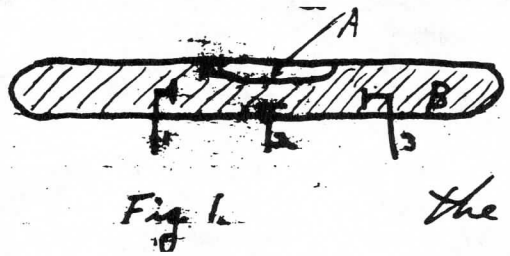


Fig 1. the

July 14, 1937

Idea for the use of a split Cowl as an element of a resistance bridge with many applications, some of which are noted

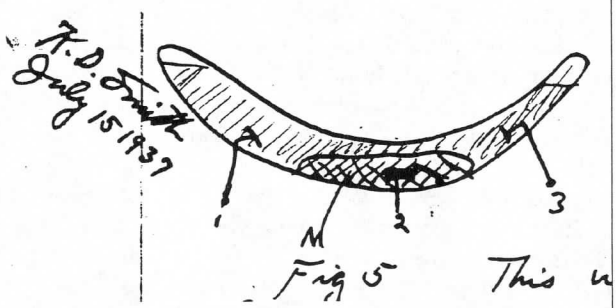
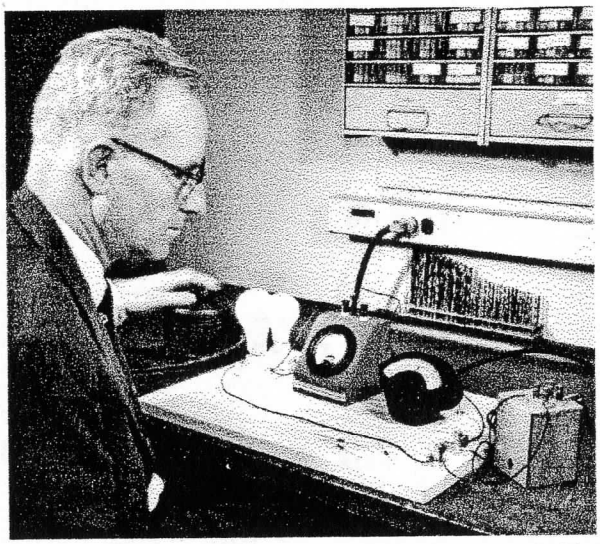


Fig 5 This

Imagine the surprise when K.D. Smith saw the top article in Machine Design! The pictures below are from a 1937 notebook that K.D. kept.

Although he never applied for a patent on this idea, I woulld imagine that he was happy to see that many years later someone else thought of the same idea!

K.D.'s notebooks are full of ideas such as this one, and you may view them at the museum library.



K.D. Smith Showing how diodes protect meters. This photo was used in his article in ELECTRONICS in 1957. The month of this issue is at present not known.

the NPN grown junction transistor. In the earliest point in the life of this device, it had been theorized by William Shockley, and a working example built by Morgan Sparks and Gorden Teal. The job left up to the engineering staff was to make it reliable, increase the frequency performance and provide it in a small packaged form. This effort resulted in the creation of a development device that was coded M-1752.

The M-1752 pioneered the way for many other forms of grown junction transistors to follow. K.D and the others that made up the engineering staff created improved versions that were at the same 50 mW power handling level as the M-1752 as well as higher power handling devices as well. The Grown junction triode was to lead to R.L. Wallace's grown junction tetrode, which led to high reliability and bandwith in reference to the time frame it was created in.

All of these devices, except the Sparks and Teal Prototype are on display in the museum for your viewing pleasure! You are able to see how the device was built, as well as seeing grown junction devices from the crude prototype stage to the production models that were used by The Bell System to make our lives more reliable.

During the time that K.D. Smith worked on the development and refinement of the Grown Junction Transistor he published the following works that document the efforts put forth on this device at the Laboratories at that time.

1. Properties of Grown Junction Transistors
National Electronics Conference, where it was presented as a paper and also was published in the proceedings in October 1952. This paper also appeared in print in TELE-TECH magazine January 12, 1953.

2. Surge Limitations of Junction Transistors: This was an unpublished paper presented at the IRE Semiconductor Research Conference June 1953.

3. Grown Junction Transistor Development: Published in the Bell Telephone Laboratories RECORD magazine October 1955. This article is reprinted in VINTAGE ELECTRICS Vol. #2, and provides a very easy-to-understand explanation of how a grown junction transistor works, and also how one of these devices is fabricated. This is really some great reading, not only for the beginner, but for the seasoned professional as well. The article covers background on the M-1752 as well as later production types used by the Bell System in production style telephone equipment. Although this article is not of the 1951-1952 time period covered in this section, it shows that K.D. Smith continued to keep in touch with the progress of any device or technology that he was once involved with. At In 1955 he was currently involved with silicon devices that will be covered in the next section.

Aside from these formal presentations and papers, K.D. Smith enjoyed sharing his knowledge and technology at smaller meetings at colleges and electronics special interest group meetings.

Chapter 12.2 and Chapter 23.1-23.1 Bell Telephone Laboratories series of books entitled TRANSISTOR TECHNOLOGY: These chapters relate to the material evaluation and parameter measurement of transistors. A copy of this is available in the museums research library.

1952-1956

Being a project engineer was nothing new to K.D. Smith, but during these years he was to explore the new domain of silicon semiconductors, such as the Bell Solar Battery, large power rectifiers, Voltage Limiters and power transistors. The reader will find more information on Bell Solar Batteries by reading further into VINTAGE ELECTRICS Vol. #2.

During this exploration of the technology he presented or published the following papers:

''Properties and Applications of Diffused Junction Silicon Rectifiers'' PGED Washington Conference 1955.

''Economical Diffused Junction Varistors'' PGED Washington Conference 1956

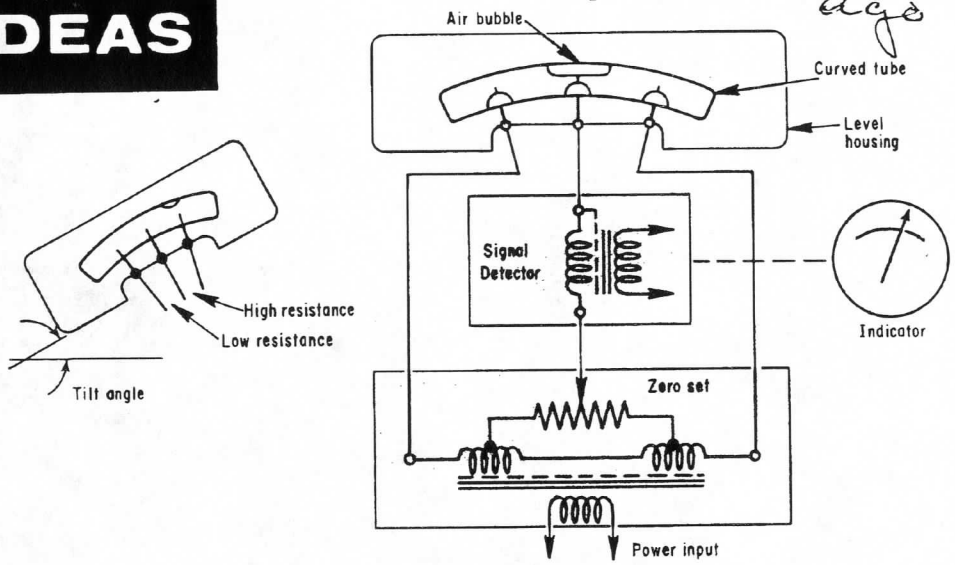
''Silicon Diffused Junction Avalanche Diodes'' Journal of Electrochemical Society, page 104 April 1957. This paper was also published in the Bell Laboratories TRANSISTOR TECHNOLOGY series, chapter 8b.

Silicon Diodes Protect Meters published in ELECTRONICS (Month not known) 1957.

It appears he was still interested in his old project area involving grown junction transistors, as he published a paper in 1955 relating to improvements in this area. See the 1951-1952 project coverage before this chapter.

SCANNING THE FIELD FOR IDEAS

I invented This
More than 30 years ago
KDS



Liquid Potentiometer Detects Tilt

A curved tube, with electrodes at the center and at each end, is partially filled with a conductive liquid. When the tube is tilted, the air bubble displaces liquid from one end of the tube to the other, resulting in a resistance change in the two halves of the tube. Thus, the ratio of resistances between the end terminals and the central terminal of the tube is proportional to the tilt angle. Device developed by British Aircraft Corp., Hertfordshire, England.

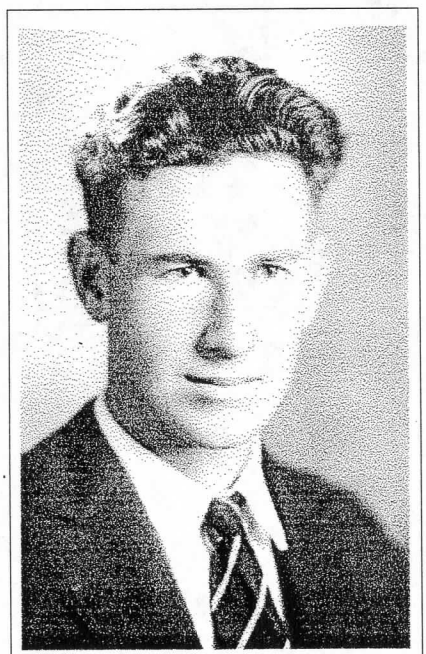


Photo of K.D. Smith Ca. 1930. This is what he looked like when he joined Bell Telephone Laboratories.

MERRIMACK VALLEY

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

Date: November 20, 1967
7:30 P.M.

AT THE

Greater Lawerence Regional Vocational Technical High School
River Road (1/2 mile East from Route 93)
Andover, Massachusetts

PRE-MEETING DINNER -6:00 P.M.

Valle's Restaurant
River Road
Andover, Massachusetts

IMPATT MICROWAVE DIODES

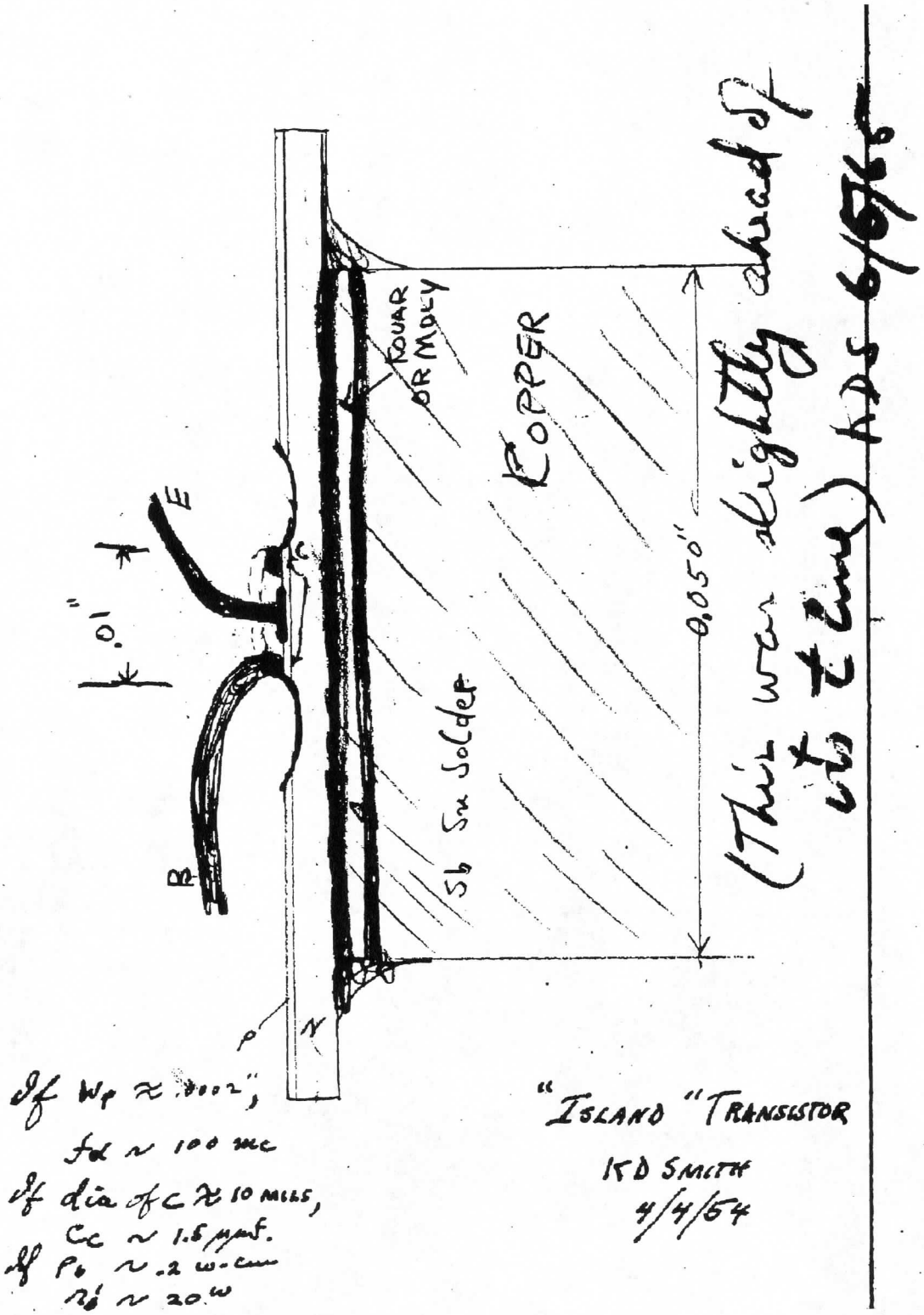
by

MR. KENNETH D. SMITH

Bell Telephone Laboratories - Murray Hill, New Jersey

Avalanche - transmit time or impatt diodes are promising solid state microwave power generators with power capabilities of several watts CW in the 5-15 GHz range and will generate useful power well above 50GHz.

This discussion reviews the operation, design, fabrication, and probable applications of Impatt diodes and compares their advantages and limitations with other microwave sources.



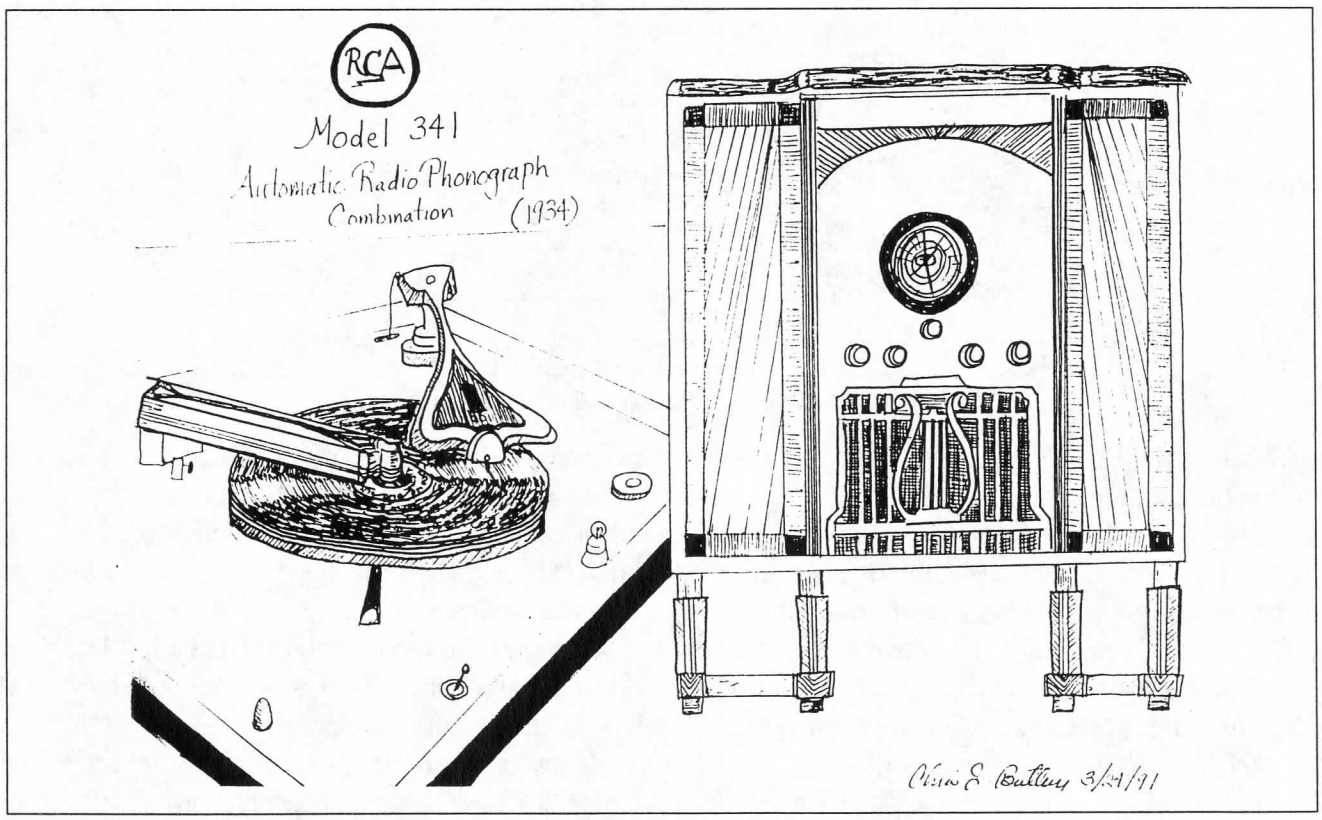
This picture shows an early design "MESA TRANSISTOR", what was called by K.D. Smith as an "ISLAND TRANSISTOR". In a later dated note that he has added, he notes that this design was before it's time. Indeed it was!

RCA Model 341
A "Classic" Mid-30's Radio-Phono Combo

Chris J. Buttery

Many of you may remember the mid-1940's Stromberg-Carlson Radio-Phonograph which I wrote about in the CHRS *Journal,* Spring 1990 issue. Since then, I've aquired another rather deluxe radio-phonograph combination, which is quite unique that I'm sure many collectors would be proud to own in their own collections. Most important though, this set helps fill a gap on my list of "long awaited" radios. I first learned of this set's general description, back in the late 1970's when I began collecting radios. Very often I've seen old advertisements in National Geographic, that described mid-1930's RCA sets that actually threw it's records off the stack into a recepticle. I was actually intrigued by this idea of obtaining a radio-phonograph of this type. Almost twelve years later, I came came across one quite by accident as part of a trade.

The RCA Model 341, is just that: a radio-phonograph combination with an early "magic brain" chassis. It is a fairly complex 8-tube superhetrodyne chassis which has four bands. Band A, covers the broadcast band 540 KC to 1720 KC, bands B and C cover the shortwave bands at 1720 KC to 5400 KC and 5400 KC to 18,000 KC respectively. The "X" band is the most interesting, covering 140 KC to 410 KC, one can pick up weather reports. From time to time I listen to the weather reports broadcast from the Oakland Airport, intended for local aviators. All bands are extremely sensitive and the sensitivity can be controlled by a knob on the front panel that controls the RF gain. On any early to mid 1930's set, this is a handy feature to have, especially if the set is situated in a large city like Oakland, where powerful transmitters are in close proximity and stations tend to overload. The set's tube lineup is typical for it's vintage. For the RF amp a 6D6 is used, a 6A7 is it's first detector and oscillator, 6D6 is used for the IF, second detector and AVC is achieved with a type 75, first audio uses a type 76, two type 42's in push-pull give at least an un-



distorted 5 watts to an 8" electro-dynamic speaker, and a 5Z3 is used for the rectifier.

In addition, the set's power transformer can be switched to use 240 volts AC, just by switching the position of the fuse tied to the AC line, which more or less completes the list of this set's special features.

In restoration, the set was rather easy to work on. One resistor and one capacitor had stopped the set from working by shorting the 5Z3 rectifier tube, which fortunately opened the fuse. These were promptly replaced, and the set came on and played beautifully. Even the original electrolytics checked as good, and there was no evidence of hum even with the set's volume turned all the way down. Electrolytic capacitors, though are funny, unreliable things, tombstone; consoles 242 and 243 and also on radio-phono combo 342 with manual phono), all the leads for the multi-section electrolytics were buried under the main resistor board which un-bolts at the top of the chassis. With the nuts removed it is posible to move the resistor board slightly and cut the leads. Once re-capped, the set performed with much more sensitivity and audio power, which has cured most of this combo's problems.

The record changer is another matter, which requires some additional care and patience in restoration. I was very fortunate, however, that the pot metal castings for the tone arm and ejector arm have held up very well, Mechanically speaking, the changer was basically working when I got it. The first thing that had to be done, was that its motor had

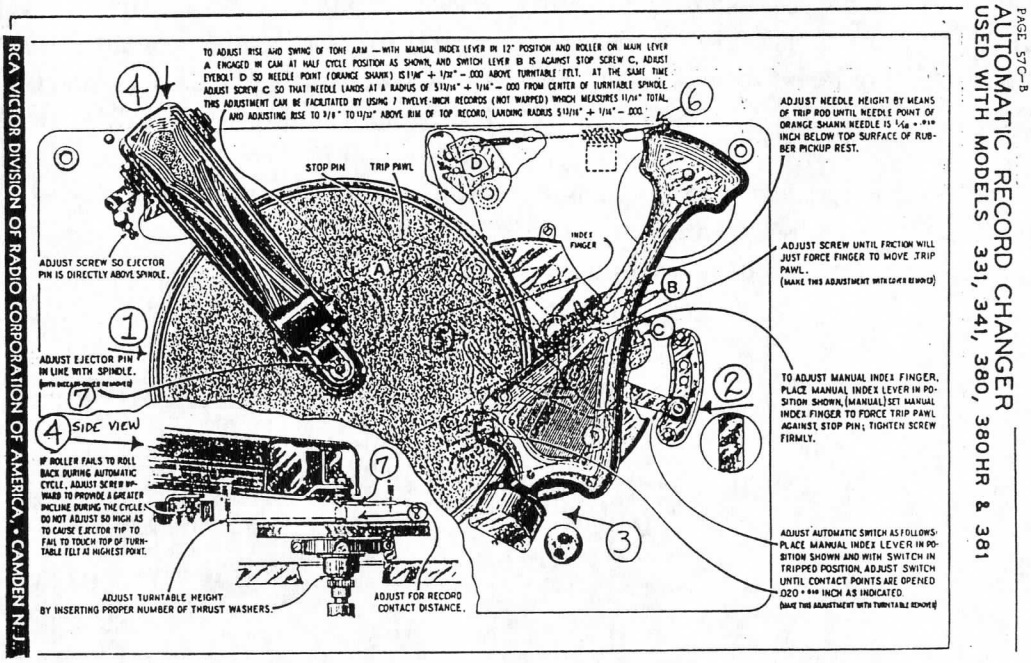


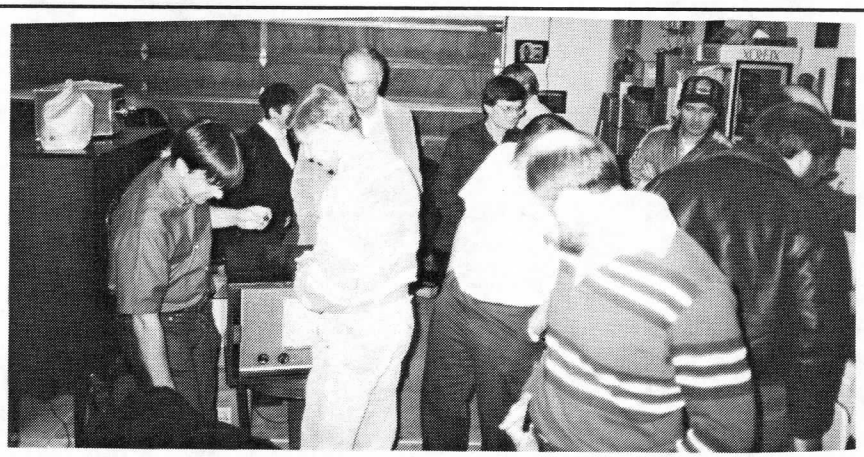
Figure 2. From Automatic Record Changers and Recorders; Rider 1941

especially if they are the old-fashioned boiler type. After about 25 hours of use, one shorted. Fortunately I was able to pull the plug in time. So, several weeks passed, I pulled the chassis and replaced all the electrolytics. Would you believe this chassis used a total of seven electrolytics! Fortunately the chassis had no floating grounds, and recapping the set was straightfoward. One word of advise, however, if you should ever come across one of these chassis (the same circuit was used on RCA's models 143, frozen over the peroid of non-use, which required me to remove it from the changer for extensive lubrication. Plenty of Liquid Wrench on the bearings, finally unfroze it, but it took a good hour of patience and peristance, to get the main shaft to move. Once the motor got up to speed, I let it run outside of its changer for a good hour or so to be sure it was thouroughly lubricated and didn't have a tendency to over-heat before reinstallation. Once replaced in the changer, the mechanism went through

it's usual cycle of ejecting the record from the turntable without stalling. Even the tripping mechanism seemed to work okay. The selector lever (see figure 2, number 2) must be set to the correct size record when playing in the automatic mode. The changer has one unusual feature, when set in the "manual" position, unlike most changers which disengage their tripping mechanism at the end of the record, this setting throws the ratchet (5) and the line switch (6) into service: when the tone arm reaches its run-off eccentric groove at the end of the record, the arm swings to-and-fro, engaging the ratchet which trips the AC line switch thus shutting off the motor. Once the arm is placed back in the resting position, the motor is reactivated automatically for the next record. This is a valuable feature for those who don't want to subject their fine records to the changer mechanism—which can be quite hard on them.. The changer also plays the 1931 RCA 33 1/3 discs in addition to the conventional 78 RPMs.

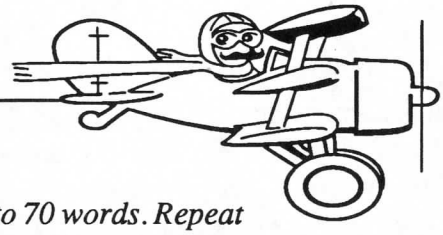
If you haven't seen one of these changers in action, they are very interesting to watch. Refer back to illustration 2. First one must place records to be played on the turntable. The selector knob must be set to the size record being played. To start the changer, one must turn on the motor and manually set the tone arm down on the starting groove. (NOTE—this changer is quite primitive, and there is no reject function to start the changing cycle) Once the record is finished playing, the tone arm follows the run-off groove and trips the changer mechanism, the tone arm left (4), during the course of playing, has been resting on the top record. It has an "inverted spindle" (7) of it's own which has kept the top record in place. The ejector arm "grabs" the record by its centerhole, and while the turntable and all records are still spinning guides it off the stack and throws it into the recepticle on the left of the changer. The ejector arm raises slightly to clear the record that is now on top of the stack. The main spindle holding the remaining records on the turntable (8) is retractable. The ejector arm lowers onto the top record, clicks into place, pushing the main spindle down one record width, ready to take on its next record, or victim. The tone arm, which has been hovering over the starting point on the record slowly lowers to start playing the next selection. This cycle is repaeated until the last record is thrown off from the top of the turntable. The operator must quickly run over and shut off the motor before the tone arm hits the motor board, or worse yet, the felt covered turntable. RCA could have designed a switch, which sensed that there were no longer any records on the turntable to play, thus cutting off its motor...this would have been a valuable feature and made the changer truly automatic. The main problem with this changing system is that it exposes the records to excessive abraision, and the high risk of them being seriously scratched, when the ejector arm drags the top record across the next one on the stack.

This system was almost universally discarded in 1938, when the first two-post drop type changers made their appearance in this country, (Garrard record changers, made in England, were using the drop type changing system with three posts and three sets of blades as early as 1932). But in spite of all the RCA model 341's shortcomings, it does represent a typical top-of-the-line RCA product from the mid-1930's.



Hubbub at John Eckland's House: The First Mini-Meet.

CLASSIFIED ADVERTISING
WANTED • FOR SALE • TRADE



Ads are free of charge to club members. One ad per per issue, limited to 70 words. Repeat ads must be resubmitted. Send all ads to the editors, or FAX to (415) 791-0584.

FOR SALE: *Radio Cast Weekly* (Pacific Coast Edition). All issues from 1925-1929 plus other magazines. Over 200 in all. All in mint condition. Robert H. Meyer 4175 24th St., San Francisco, CA (415) 282-5416

CLEARANCE SALE... Tired of waiting for swapmeets?!?! There are always antique radios for sale Jim McDowell, Home Video Service, 101 E. H Street, Benicia, CA (707) 746-5557. Over 50 radios from $5-$125; 1928-1958. All in working condition. No cathedrals or catalins.

WANTED: Zenith Stratosphere radio. I will make all shipping arrangements. Jim Clark, 1292 Starboard, Okemos, MI 48864 (517) 349-2249

WANTED: Junker Zenith model 3000-1 TransOceanic. Paul Bourbin, 25 Greenview Court, San Francisco, CA 94131 (415) 648-8489

FOR SALE/TRADE: RCA CT-100 15" color TV (RCA's FIRST) circa 1953. Working condition w/ good CRT! Sonny Clutter 14407 NE Fremont, Portland, OR 97230 (503) 233-0049 - work, (503) 254-9296 - home. I can arrange delivery on the West coast.

FOR SALE: *Rider's* Vols. 1-5 abridged and 6-15 in Rider binders, Vols. 2-3 in Nat'l. Union binders. Sell as a set only, $250/trade. Chuck Bennett, 1501 Argonne Drive, Stockton, CA 95203 (209) 465-6542

FOR SALE: Solid state Heathkit test equipment. TV post marker /sweep generator model 1G-57A, $60; Color bar/ dot generator model 1G-28 $660; Dual trace oscilloscope/ 5 MHz model PKW-105, $15. Insrtuction manuals included for each piece of equipment. Walt Blair, 35 Royal Way, San Francisco, CA 94137 (415) 585-0174

WANTED: Radio store advertising signs, displays, banners, etc. I have trade items. Always looking for Remler Scotty radios, any condition. Adam Schoolsky, (415) 791-0330. Out of area (800) 321-RADIO

"Do we have to take this stuff home... AGAIN?