

Rein Narma - The Fairchild 670 King

A while back, I bought a Mackie 1604. My first piece of studio equipment. Needless to say, I thought I deserved better. So I went lookin, and, long story short, ended up here, via Kex and his GroupDIY. (speakin of....)

Fletcher, of Mercenary Audio, has a great article at his site on "vintage" equipment. After I read the part about: "This 64 pound muthawas tweaked in Les Paul's living room"...well, that was enough to get my attention. Further research revealed that the 660, or 670, in possibly modified form, was used during some of the Beatles recordings. Now, I was really hooked.

So first, I payed Fletcher to run across the street on his Harley to make a giant copy at Kinkos. I received the schematic, and taped it to my closet door, next to the kitchen. There, I would spend endless hours, tracing out all the lines, trying to figure out what kind of an SOB it took to design such a monstrosity.

This led to a search. Not an easy search. Do a Google on Rein Narma, and all you will get is a guy who manages a Hotel chain down in LA. (This is Tein's son, by the way)

But if you search carefully for a couple of weeks, months, years, you will finally come up with a lead for a company named Contec. I made a call to Contec, and the Secretary there was very nice. She gave me a phone number, and I had a nervous chat with Mr. Narma about four years ago. I thought he would be retired, sitting back in his easy chair, smoking a cigar and reading a magazine. But this was far from reality. Rein was still very active in the business world, he sat on the board of three different companies, and was probably looking for number four when I got a hold of him.

He disappeared off my radar for a couple of years, me busy researching other vintage equipment, and him, unfortunately, taking care of his sick wife, who sadly passed away a few years before the interview. I thought I had lost him forever.

So with all of that, we finally got together at the Crown Plaza Hotel near the San Francisco Airport. Rein was going to check out Stanford University with his Grandson, to see if he would be interested in attending college there. So while he was down, I "snuck" in a three hour interview, the contents displayed here for your reading pleasure. Enjoy!

INTERVIEW *Tape A Side 1*

[cj spreads out 670 schematic on coffee table at SF Airport Hotel Lobby]

"I remember designing this in my cellar. And very few revisions. It's actually a very simple device"

cj- How does it make you feel to know of all the music that came thru the 670?

"You see, as you know, I worked as a recording engineer."

cj- Was that with Gotham Sound?

"Actually, quite a bit before-United Nations Refuge- so particularly at Gotham, I found the inadequacies of equipment that then existed.

First of all, there were several compressors, or limiters, in the market that day, but they all did too much damage. Having had the opportunity to record everything from radio shows to orchestras and manipulating the microphones, multiple microphones, that I quickly learned how difficult it was to maintain things within the available dynamic range.

I also found that the then existing standards originally set, I think, by Western Electric, were supposed to..... which had the nominal line level of plus 8 dbm, and that most amplifiers started clipping at about plus 18.

That was....the 10 db was totally inadequate.

The first line amplifiers I designed, I needed to move that up an extra 10 db..which was minimum...but even that was inadequate.

Then knowing the problems that existed with limiters, I tried to find a way that had some intelligence in it. It was part hobby, part professional curiosity.

To the best of my knowledge, this was the first device that sensed the nature of the music, and hence, set the time constants of both reduction and, release from reduction."

cj-Different time constants...

"And multiple, simultaneous time constants."

If you have a number of, for instance, if something comes along like a symbol crash.

A single symbol crash has a very fast attack time, and also, a very fast release time. So it merely suppresses the volume of that symbol crash, but returns fast enough so that nothing interrupts any of the steady state level of the rest of the music.

So I did the calculations, and then I tried it with various musics until combinations of calculations, and trial and error, I ended up with a set of multiple time constants."

cj-This was probably where most of the tweaking took place...

"That's right. First problem was trying to find tubes that could maintain their linearity over a very broad range of transconductance change.

And I looked through every available piece of literature and eventually found a potentially military used that came closest, and tried it.

It was not the only one that I tried, but this one, (cj - 6386) - came closest to having meeting the requirements.

I tried half a dozen.

Most of the others that I tried didn't come as close to it, simply because they had too high a transconductance.

I didn't need any gain.

I needed just enough gain to take care of some attenuation losses, so you had a control of while your adjusting.....

But this was near ideal from the then available tubes.

And I tried quite a few, and found that typically, they came fairly well matched.

Essentially, the key is you have a very large control voltage compared to the signal voltage.

And hence, in order to eliminate second order distortion products, everything needed to be perfectly balanced."

cj- Especially if you are doing stereo, your imaging becomes a problem...

"That too, but initially, the first version was the 660 - single channel only.

But it was equally important here, because the distortion products became very, very audible.

Particularly the most audible products, which was then called the I.F, the beat between two high frequency products, creating a low frequency distortion product."

Rein: (pronounced "Rain" BTW)

"Anyway, next problem was finding the transformers.

Most transformers claiming exact ratios were far from it.

They were several percent of balance, but no where near what I was looking for, you know, within a tenth or so."

cj - Now how did you test these transformers?

"Oh, that's actually easy. All you do is put in two signals and don't get any out! I didn't have to have too much sophisticated equipment at the time, but most things were readily testable by using simple logic.

cj - Did you find problems from one unit to the other, as far as transformer consistency ?

"I found much more problems from manufacture to manufacture, than I did from unit to unit - within the manufacture. I found some problems with individual units when we started to make the units. The first 10, or so, units of the 660 were all built by myself, personally."

cj - Wow, thats a lot of work!

""That's right!"

cj - did you eventually end up with customers?

"Oh yes! The first one, I think, went to Doctor Rudy Van Gelder."

cj - The Jazz recording engineer who recorded from his house?

"That's right. I think he has the first one.

I also built my first recording console for Dr. Rudy Van Gelder.

The second one went to Olmsted Recording in New York City.

And then came the big one for Mary Ford and Les Paul."

cj - Now clear that story up on his involvement...

"While at Gotham Recording, Keith Herb and I, Keith Moss and I, (cj -Zimmer appears here for some reason) we established a company called Gotham Audio.

The intent was for us to design and build recording equipment.

I designed a new set of amplifiers, again, in my cellar, for the Ampex 300.

I learned of deficiencies of that, that was then the best professional tape recorder available. Any product has some idiosyncracies (sp), and some problems. One of the problems was the unbalance of the bias structure. They compensated dC bias applied to both the erase and recording head.

And this was a major problem. It created some noise and other distortions.

I designed a new set of amplifiers, plug in modules, this was supposed to become the product for Gotham Audio Development Corp. I built a few in my cellar."

cj - Now did these plug into existing Ampex tape decks?

" Yes. You take out the big single chassis unit, and go in with a tray that playback amplifier, recording amplifier, and a power supply, and an erase...

cj - so all that was left was the transport..

"It replaced the entire electronics.

So that became known and I think its at that point that Les Paul heard of me.

And he was curious because of this multiple use of the recording, over and over again.

So when he received a new 8 track recorder from Ampex, it was totally inadequate - the distortion products were terrible, and it was far worse than the two channel recorder he had previously.

You can almost expect to multiply the problems as you increase the complexity of the system.

Anyway, so having heard of my amplifiers, he ended up calling me, and I went over to his place and I fixed some of the problems on the spot.

Some were more adjusting, some of the basic problems...but...

cj - He was living in the backwoods of New Jersey back then?

"Yes he was. Anyway, at that time, I had already..... Gotham Audio Development Corp had broke up because the two other departments were having a fight with each other, the money guy, we were not making any money.

He wanted out, so I left and I went to Fairchild.

I became initially, the Chief Engineer of Fairchild, thats a long story, too."

cj - Now this transformer here, is actually an A-26, which is an output transformer turned in reverse. Is there a reason for that?

"Right, because these were transformers available off the shelf, from the catalog.

So I needed a particular input ratio. This one had the right ratio.

cj - Were these parts on the shelf at Fairchild?

"No, no. I had nothing to do with Fairchild at the time.

Anyway, when Gotham Audio Development Corp broke up, then I became my own company.

Rein Narma Audio Development. After Gotham Audio Development broke up, I continued to work in my cellar.

cj - Was this in Long Island?

Nope, this is still in Bergenfield (?), New Jersey.

Also, when I did this, and also took my very first vacation with my family.

I went to Florida, and while I was....and I left because I was sort of in business, on vacation, I set up an answering service.

So I remember I was on a beach, at a place not far from Pensacola Florida, the Bell Boy comes running to the beach, asking us urgent phone call.

I run back to the hotel from the beach and it was Sherman Fairchild."

cj - Now how did hw know you were down there?

"Oh, well, very simple. He said "I had a little company on Long Island.

I just pulled it out of the companies called Fairchild Recording Equipment Corp.

How would you like to become my Chief Engineer?"

"Sounds fine" Anyway, he had not met me, I had given a number of technical speeches, mostly at the A.E.S."

cj - So you were an AES member in the beginning....

"I was a member way back, I think the...some of them I was trying to get published, others , you know, I was too busy, maybe the first one was the compromise between noise and distortion.... was my first AES paper.

Rein:

"Anyway...but the one that actually....

He was virtually.....Sherman was at virtually everyone at the AES meetings. So if I remember, this was while I was working for Gotham."

cj - You might have bumped into him once or twice.....

"I saw him a couple of times and once I even remember walking back from a meeting to my workplace...us...46 St...so he knew of me, this was a fairly closely knit society, there were a number of people that I knew.

I knew Jim McNight for a long time, he worked for me for a long time, he worked for me for a while, anyway,, so I wentyou can say....zig zag...all the way through...."

cj - Did you have to relocate when you worked for Fairchild?

"No, I didn't, because I had moved from ..oh...to a better home in the meantime, from Bergenfield to Westwood, New Jersey. I was commuting to Long Island, to when I was at Gotham. Anyway, so I was there."

'He (Sherman) was one of the most intelligent, probably THE most intelligent guy I have ever known. And the most productive guy I have ever known."

cj - You learn a lot from being around a guy like that...

"Absolutely. You could almost write a book about him.
Anyway, first thing he said: "I don't like accountants"

He is the co-owner of this company, and ah, he is the General Manager, but he (Sherman) is the Chairman of the Board, and the CEO."

cj - I guess the spy camera was the first thing that got him on the map...

"He invented all these things, himself, too.
Thats right.

Aerial Surveillance Camera. And he found that there was not an airplane stable enough for it, so he redesigned an airplane. Anyway, he said: "I hate accountants. This is what I will do, This is your budget. I put this amount into your engineering account. You write the checks. You pay everything. Get the secretary to balance the books. You know that "X" amount of dollars will be put into that account every month, and you do the best you can to get the job accomplished."

cj - A lot of artistic freedom here....

"Thats right. He was ahead in many ways.

After my year, he decided that in as much as the goals for the people that deal with engineering and manufacturing are very different than the ones that deal with sales and marketing, so I am going to divide the company, and you, Bob Costem, you head the sales and marketing part.

You bring sales to Bob, and your profit is measured on the difference between your standard costs and your actual costs"

"Now I was the General Manager of that portion, manufacturing and engineering, of that part of Fairchild. In as much as Gotham Audio owned the parts, and I had this product, I licensed Fairchild to make this. (points to 670 Schematic)"

cj - Was the 670 the first thing you did when you got to Fairchild?

"Soon there after, because I had the product and they were interested, so...."

cj - Now how comw you have so many tubes in here, you need to keep enough plate current so that you don't get starved....

"The whole point was that I had to make sure that I can have under all conditions, a 20 db clearance from the maximum operating, but I knew that even 20 db was inadequate. The units that I purchased, the first recording type amplifier that I designed, which was written up, I did write up the paper, I'm not quite all the way....had a clean output of plus 30 db. Anyway, sothe whole issue was that I wanted to have enough clean headroom, so to speak."

cj - That helps for balancing tubes too, if you have differences in tubes...

"That helps too, yes.

cj - Now did you have to match these tubes up at different points in the graph?

"At the time, the ones I selected...."

cj - You didn't have curve tracers back then...

"We had very little sophisticated equipment...."

cj - You had to do it all by hand...

"That is right. I had a oscilloscope, an oscillator, a VTVM, and a few things of this kind, but I didn't have any sophisticated equipment at that time. I found actually that like , four out of five of the tubes that I checked matched very well."

cj - How about the availability?

" Apparently, it was readily available.
It might have been surplus, or whatever, but it was very available."

cj - Do you know how much those tubes go for nowadays?

"No."

cj - Probably about sixty dollars a piece.

"They were two or three dollars then. It was an RCA tube then. I think RCA made them at the time."

cj - How many of these darn things were ever produced? Any numbers?

"I don't have any numbers.

cj - Every studio seems to own one...

My guess is maybe thirty, forty,...."

cj - Is that it?

"Thats probably it.

Because the guy who took over, after I left Fairchild, the other things didn't kind of care too much about professional equipment quality.

I think they may have discontinued....they may have been thinking of ot.....there was a fellow by the name of Putnam....

cj - Is it the same guy who worked for Iniversal Audio, or UREI?

"Might have been....the important part also....because at the same time, we were working at Fairchild to develop the first stereo recording cutter head."

"The prior cutter head was just two Vector cutting heads that had been put at right angles to each other. Thats the way the early records were all cut.

And this was a redesigned one, specifically for stereo recordings.

And a fight was going on between the Europeans and the U.S companies here , whether the recording ought to be vertical/horizontal, or 45 - 45.

In reality, in both cases, both elements have to be considered.

As a matter of fact, the European vertical/horizontal cutter would have been a serious mistake.

Even though the Europeans were pressing it, simply because the recording characteristics behavior of a vertical stylus is very different from that of a lateral stylus, much more seroius limitations on the vertical recording than you have, so in as much as the same problem exists whether you use a 45 - 45 , or a vertical/horizontal approach, you have to limit your vertical excursions as compared to your horizontal excursions."

cj - Did you have to write the 670 manual yourself?

"Well, yeah. I also wrote a paper which was published by the AES about the.....that deals with one specific issue, namely the recording angle difference between the recording and the playback (cj-Rein is getting me back on track, I was trying to get more 670 dope.) and how major a distortion factor this can become.

There were no standards set.....

cj - Because the record is cut a certain way and is played a different way....

"Thats right, and not only that, you end up with a very peculiar fundamentally frequency modulation that transfers into a back and forth movement, a difference of that angle.

Anyway, so recognizing this, that was also the reason for setting up a means to take a stereo signal and control the vertical and the horizontal separately."

cj - So this was designed primarily for record cutting?

"That is right."

cj - This is a very clean audio path.

I mean it comes in this transformer, and out the other side, no capacitors to color the sound...

"The idea was to make it as simple as possible!

The whole idea was to make sure everything is in balance and if it could have been done without any...these are parts we needed to control the amplification, if you please."

cj - The push pull aspect, well, that tends to cancel out distortion...

"Thats right - any even order products, and not only is it balanced here, but it is carefully balanced as far as here: (Rein points to control amp output)."

cj - Now as the Gm's of these tubes change with different bias, you can run into distrotion....

"But essentially it all tended to maintain balance as close as possible."

cj - And these are probably pretty good over a long period of time, as far as being balanced, because you you have more than two tubes...

"Yeah, and fundamentally, because of the physical..... on a tube with a low transconductance and the wide range over which it can operate, makes it critical.

You know you don't have the problem that you have with high transconductance elements, where the spacing becomes critical."

cj - Discussing the transformers...I got mixed up with...Triad...UTC...then realized that the output was a Triad.

Speaking of UTC, this is no longer critical...this is not a critical...(cj points to control input transformer, past the resistor network)

"No longer critical. All this does...this is nothing more than a simple power amplifier to provide a low output source for the control voltage, thats all."

cj - Is this (points to resistor network again) to buffer this from your audio output...

"Yeah, you don't want to load the output, so you bridge it."

cj - Now this is a lot of amplification just for a control voltage here. You really want to slam these capacitors hard...

"The whole point was that I wanted to have a better than a one tenth of an ohm source, in fact, 0.05 ohms, or something like that.

I wanted to be able to....since I had no anticipation time, I mean I only get the voltage at the time it comes, so you have to act quickly enough so that it does not...it's there to reduce it before it rises to the point where it can overload.

Maybe I overdid it at the time, but...."

cj - If you were to redesign this today, would you use a solid state side chain?

"Yes I would. Put a simple little opamp in there."

cj - And maybe the power supply, you might have some regulators...

"Oh sure. That's right. That would be all silicon regulator."

cj - You didn't have silicon diodes back then, did you use germanium diodes on the control output?

"I don't....actually, germanium is...silicon has a drop of 0,56, germanium has an intrinsic drop of 0.3.

I know I choose again, whatever gave me the lowest possible drop of the two.

Probably much better devices today."

cj - Why did you use feedback in the control amp?

"The whole point here is that what you'd like to do is make this output impedance as low as possible.

So obviously if your nominalfor the sake of argument, is eight ohms or whatever it is in here, and you have twenty db of feedback, then your eight ohms becomes a tenth of an ohm.

That's the idea."

cj = This 12AX7 is biased so that it can go into Class B...

"You have a problem with Class B when you use feedback. There has to be, theoretically, at least some gain available for feedback at all voltage levels.

In a Class B, you are virtually at cutoff at one point, which means there is no feedback at that instant."

cj - Since you did this in your basement, that means you were the only person who worked on it?

" That is correct. I had no help...when this was put into production at Fairchild, as a matter of fact, the conversion from...uh....the understanding was, at Fairchild, I gave them a limited license, and I got something like a hundred bucks per unit.

I don't even know that I got paid for all these things, people left, and I got busy at Ampex."

End of Tape A - Side 1

Tape A - Side 2

cj - did you ever own one of these?

Or do you have one laying around the house?

" No, I don't."

cj - How about the original prototype?

"Well, there is no prototype. I sold it to somebody, because I needed the money!"

cj - What did the prototype look like?

"I made the original drawings for the chassis, and so on. Not for the 670 version. Just the 660."

cj - Then you just doubled it and put it on a bigger chassis?

Precisely. Putting into the stereo form was done at Fairchild, and there was one engineer whose name was...Irving Scoves

(? cj - I know this guy, I have an email, I think his name Saul, or similar, he even might have posted here once) who was a very good engineer that helped me get it into the stereo version."

cj - there is a lot more wiring, because now you have that matrix switch going on...

"That's right. I did it in a similar way with the mono version.

cj - Did you have any problems with the layout, as far as oscillations is concerned? Did you have to move wires around, or did it come out right from the git go?

"You always have these problems, but I designed and built quite a few amplifiers. You would be surprised. Even when I worked for the United Nations Refugee, there was no recording equipment available for the field.

And this was in the forties. So I had to build my own little recording console, which I drove around in a Jeep, all around Europe, to the refugee camps."

cj - Now how did you get interested in that?

(long silence)

cj - Sad story?

"Hard to tell."

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"I came from Estonia, originally"

Both my Father...and when we were occupied by Soviet Russia, Estonia was...and my Father....was arrested, and....by the Soviets occupation.

And my wife, came also, from Estonia.

Her Father, was also arrested by the Soviets.

It was during the second World War that I escaped, and I had built my first radio, probably in early high school, from scratch. Sort of a hobby. And I wasn't a soccer head, and it was chemistry and electronics that were my early interests."

cj - Were both your parents born in the same town?

"No, they were not. My parents were born in different towns in Estonia. My mother died when I was probably fifteen years old.....just before they.....anyway,, I escape during the second World War, and ended up at the (?) I came through the various countries, south and then....at one of the refugee centers, US Army came in and...."

cj - How did you get out? Smuggle yourself in a shipping crate?

"Well....you'd be surprised. Nobody payed much attention. You see, all the movies, and so on, during that time, nobody checked anything. Loads, trainloads of people escaping from oncoming Russia."

cj - How old were you when you decided to leave?

"In my teens."

cj - Thats a pretty big decision!

"Of course! But I hated the Russians. Because of what they had done to my Father, my country."

cj - Did you have brothers and sisters that were also tryng to get out?

"Yes, my Father stayed, one of my sisters, one of my brothers, some stayed, some came, there was accident, as a matter of fact, one died....two died..not survive..anyway, as I met the first Americans, and they asking "does anybody here in camp speak English?" English is my fourth language, third foreign language, so then after they got group together and asked " does anybody know anything about radio?", I put up my hand.

So before I knew it, I ended up working for the United States Army."

cj - Thats a good transition!

"And guess what, that was the First Division Training Regimen, and that was the organization responsible for the Nurnberg Trials logistics, so I was one of the guys who set up and maintained at the Nuremberg Trials....."

cj - And they used to broadcast this stuff.....

".....the simultaneous translation equipment, it was IBM at the time, and I was the guy that helped set it up, and to maintain....that equipment, and the recording equipment."

cj - How long did that last?

"I was there through the International War Crimes trials, and through the following trials for the Nazi doctors, and so on.

So I was there for approximately three, almost four years."

cj - Were you a civilian working for the Army?

"I was a civilian employee, and I payed my own rent, and through the time that I met my wife."

cj - She got out, too!

"She got out too.

cj - A lot in common, I guess?

Yes, and she passed away last December. (2004)

cj - Thats a long time together.

"Married for fifty years.....fifty-six years. Anyway, so from the job working for the military, at the trials, my next job would be for the United Nations Refugee Agency. I moved to Geneva, Switzerland.

Thats when I started doing recordings of music, and so on, going from refugee camp, to refugee camp."

cj - That was kind of like the Lomax recordings, with the wire recorders, and such....

"I learned the practical problems of equipment, and of microphone placement, and editing, and all of the rest of it."

cj - Was that wire recording back then?

"No, it was tape.

cj - They had tape back then? That was 1946?

"I think it was 47, or 48. Tape recordings existed,"

cj - I knew Harold Lindsay. He worked for Ampex.

"Yes, I know Harold Lindsay."

(note:Lindsay was responsible for telling Ampex about tape recording-Germans had it first, trade show rip in SF)

cj - He told his boss, Mullard....anyway, back to the refugee field recordings, how could you make money at that?

"I worked for the United Nations Agency as a public information officer. My job was to go around Europe and accompany correspondents from various countries, do some interpretation for them..."

cj - So the field recording was a side line....

"That was part of my job. That was my specific job."

cj - Now do you still have any of those tapes or anything transferred?

"I had a record made of parts of those tapes. So I have a vinyl record of those tapes."

cj - Probably made ot on your own lathe!

"No, none of that existed at the time."

cj - So how long did the field recording go on?

"That went on for about two years. But then my next job for the United Nations, which would have taken me to Tokyo. And my wife didn't want to go. She said its time that I start to exercise my profession as an electronics engineer, instead of continue to do these things.

So I decided I better come to the United States."

cj - Now you had no formal college training....

"I had a fair amount of college training, but no degree. So I take lots and lots of college courses."

cj - Did you go to college in Germany?

"No, Estonia. We had a wonderful system, while going to high school, you can take college courses, and get credit for it."

cj - So you were an advanced student?

"You betcha!

cj - Taking Calculus when you were sixteen?

"Yeah, so I had a fair amount of formal education, but no formal degree."

/100 minutes/

cj - Did you have to travel around a lot, while doing the field recordings?

(doh!)

"I traveled around a lot. Mostly Germany and France."

cj - You were living in tents and stuff like that?

Typically, most of the time I lived in Geneva, Switzerland.

And part of it, inside Geneva, and part of it in the suburbs, and for a short period of time, in Lake Geneva.

Anyway, my first job in the US, the first job offered to me through one of the correspondents, who recommended me, from inside the United States., was working for Gotham Recording."

cj - Now, you wanted to come to America, when you got that job with the Army, you knew you had a passport...

"I was making a little salary, and my living costs were all paid by the United Nations, and we lived like kings. And I came here, making about fifty five dollars a week, and I payed for everything. I had a wife and a child, and a second one coming, so I very quickly found I had to have two jobs. Daytime, I worked for Gotham, at night, worked for various people, mostly for Rangertone. He.

...(Rein is talking about Richard Ranger:

<http://www.keyboardmuseum.org/pre60/1930/rangertone2.html>

early heavyweight in the audio world-which I had no clue about at the time)

"He was the one who brought magnetic tape recording to the United States.

He was Signal Corp Colonel during the second World War. Signal Corp Intelligence Officer, that actually imported the magnetophone and its technology, and also taught us how to make it. So initially there were two companies who made recordings: Fairchild, and Rangertone."

cj - Were there any products in Germany when you were over there, like Siemens compressors, and so on? (some people think the 670 is borrowed from an earlier compressor, I did not like to ask this trick question, but ...)

"Dealing with radio stations and so on, in my contacts, we had the opportunity to use the studios to do the recordings. Other than seeing the magnetophones in the radio stations, I had no contact...."

cj - because a lot of that stuff never came over seas back then, its not like you could copy this, or that. They had their stuff, we had ours...

"They had a homogeneous tape running at 30 inches per second."

cj - There was a story I heard, when Les Paul got his Ampex eight track, and discovered that it was running at fifteen inches per second, and he demanded thirty, and they said they were not going to do it, so he drove it out to the west coast, and parked it in their driveway...

"The fact is that when he got this recorder, he ended up calling me, and I ended up cleaning up the most obvious problems, which were mostly adjustments, and then it was indeed sent back. But there were some recommendations that I made for obvious changes."

cj - Did you come through Ellis Island?

"I came here as an employee of the United Nations. So I flew.

As I continued to work for the United Nations Agency while I was here, I had a job with them. I flew in as an immigrated immigrant."

cj - Were they in Washington, DC?

"No, they were in Long Island. Anyway, it was because of the Les Paul connection that I became known at Ampex. It was Walt Self (?) that was doing the engineering while I was working at Fairchild, who called me."

cj - Thats how you got out to the west coast?

"Thats right."

cj - You were looking for a new job?

"No, I wasnt looking for anything. I was happy at Fairchild."

cj - They stole you right out of Fairchild. They must have made a nice offer in order to get you out here...

"They wanted me to manage their audio engineering department. Snyder was one of the guys at Ampex. And Walt Self. They came up here for dinner and put me through, which was typical at the time of what everybody did, put me through the battery of psychological tests. For intelligence, and all the other measurements that they do."

cj - Now Ampex wasn't very big back then...

"Anyway, whatever it is, I passed it.

No, it was not. As a matter of fact, sales were twenty, thirty million. They had come in and made me an offer. And I told Sherman Fairchild. Sherman called me to his house and we spent the day talking about it. Then, in a day, he came back to me, said "you know, Ampex is a leader in this technology. Maybe your opportunities are better there."

cj - Was he getting out of the audio bussiness back then?

"I would say audio was more of a hobby for him. Because he was in love with piano. Piano music is among the most difficult to record. And in his house there was a regular recording studio. Very interesting house that he designed. Had no stairs, slanted ways to walk up from one floor to another.

And a very nice studio. He recorded piano music there, and other recording artists.

He told me, that in his opinion, I would be better off professionally, if I accepted."

cj - Did Sherman make you a counter offer?

"No. We had a very open relationship. He just felt that....that he was not going to give me the same opportunities."

cj - He was your friend, and your boss...

"Thats right. Exactly. He had become my friend."

cj - Speaking of piano, did you ever play an instrument?

"Yes I did. I've got a piano.

And I played trumpet and the coronet in a marching band, and I played trumpet in an orchestra in high school. I wasn't very good at it."

cj - But still, it helps you with things like the 670, being an engineer and a musician at the ame time....

"Thats right. I surprised my children, and my boss. We were at the New Monterey Jazz Festival, which it was called then. They had two. This is not the main festival.

I picked the winner and third place out of thirty orchestras, prior to the announcement. So I still have reasonable hearing."

cj - So you are out here at Ampex. What did they have you do when you first got out there?

"When I first got out there, my first job was manager of audio engineering."

"Ampex Professional Products Company. Just prior into being divided into multiple companies. And they were in a great mess. I couldn't believe it."

cj - They have had their ups and downs...

"Yeah, but they were in even bigger trouble than when I came up. They were in the final stages of getting into production of a product, which was basically ill conceived. Called VR-10. Too many unproven, novel things in it."

cj - Was this video, by any chance?

"No, no, this was audio. I will get to the video part later. My big mistake was that I should have at the time, despite the fact that it was in the early production, if I had the power, I don't know whether I had or not...."

cj - Cut your losses....

"I would have stopped the project. Instead, I continued to help it along. By the time I got to Ampex, the fellow who had hired me had left the company, so I had a brand new boss by the name of Carlson, who was a salesman. A few months after that, he got a new boss. And another month or so later, he went out to move the family to the west coast. I was called into his boss's office.

I forget his name. He says, "Rein, very sorry, but we have decided to discontinue the audio business."
So I no longer have a job."

cj - Now how long were you out here?

"About three or four months. But the boss said - "why don't you go and see Herb at Ampex Audio. He may have a job." Ampex Audio was a consumer product part of company. They had divided the company into five different departments. One of the errors of over expanding into God knows what. So anyway, I remember driving my Peugeot 403 down 101 to Sunnyvale to see Herb, to see what happens next. So not only did he want me, but we have also taken that other section he called Advanced Audio, and that too will move here, so that also has Jim McNight will also report to you, and I am not going to discontinue Professional Products all together, so we will move some of them.
So I became the director of audio engineering now, and all of these things."

cj - Well, that's a good turnaround...

"Only for a while. So that went on for about two years, then another big change. Bill Roberts had now taken over the company, he had been executive VP of Bell and Howell."

(cont)-Rein gets to Ampex on the West Coast)

"Bill Roberts (?) now taken over the company, he had been executive VP of Bell and Howell, and he had been a consumer products guy. And he wanted nothing to do with Professional Audio products. He wanted to press consumer products. They were in Redwood City, or Sunnyvale. And he decided to move that business to Chicago. Very hesitant. I had trouble at the time, making decisions. Finally I decided to go to Chicago.

With the understanding that there's going to be a new video project that was to sell. Kind of a corporate R & D group. He assured me that you can do anything in video and stereo.

{ He is very quiet here, unfortunately: It did...head of....video apparatus ...this excluded the four head recorder.}

"I headed the development of video recorder."

cj - Now had you ever worked in video before?

I don't know that I knew a lot..... oh yes I did. I didn't tell you, I said I wanted two jobs. One of them was for Ranger. While working for Rangertone, one of the projects taught was mine, was to develop the first electronics video recorder.

It was technically a very successful project, but the rest of his projects were never commercially...(?).

The reason I quit the Rangertone job was my payroll checks bounced.

cj - That's not a good thing when you're trying to pay rent and raise a family...

"This was a very interesting project, and had it had the money behind it, could have fundamentally replaced the electro-mechanical means of recording sound on film.

I used a flying (spotz?) head and pulse width modulation. So I became quite familiar with video problems on this Fairchild R & D project.

Had this come out a few years earlier, you could really make...this could now be a high contrast recording that you could record digitally if you wanted to, you could make very distinct, very high fidelity black and white soundtracks, fundamentally because essentially audio represented by the length of the high frequency pulses, which could be recorded in the same space as the soundtrack was. Or you could use it as a recorder."

cj - This was pretty advanced!

"Of course! He was a fantastic guy."

cj - Sort of like twenty years ahead of its time...

"That is right. Sort of funny. He inherited, from his wife, a million dollars.

His wife's parents had, for the mentions of honor, the Louis machine gun built during the first World War. Sherman Fairchild inherited a million dollars from his Aunt in IBM stock.

Sherman was a billionaire when I met him.

And Richard Ranger, Col. Ranger, died bankrupt. But the work I did there was unbelievable. We were way ahead of the world, but none of those things ever commercialized.

One of those things - An idealist, looking for perfection, without a means of implementing it commercially. While I worked for Rangertone, I looked through the old books of some of the clippings, and so on. We did make headlines in the New York Times: First person to succeed in transatlantic facsimile picture transfers."

**cj - That would have to go through the transatlantic cable.
You need some bandwidth for that.**

"This was wireless. Wireless facsimile image transfers."

cj - Thats basically a Fax Machine without the phone line!!!

"Yeah, thats right. Anyway, that was Richard Ranger."

cj - The guy sounds like Leonardo Da Vinci, inventing helicopters in the 15 th century. So how long were you on the West Coast?

"I was on the West Coast for approximately two years. I moved from my laboratories from Redwood City to Sunnyvale, and then onto Tyco (?) Village."

cj - Did you live in Woodside the whole time?

"No, I lived in Woodside part of the time, and San Mateo."

cj - Still remember where your old houses are?

"Yes"

cj - Drive by there?

"I did once. 875 Petrole Rd, Woodside."

(Rein is 90 something, must have not done a lot of drugs!)

cj - From the sunny West Coast, to freezing Chicago...

"Yeah. So now I headed this project, which as based on what was considered to be a new concept of a single rotary head video recorder, based on dual rotating drums. And I had to hire....I had an empty house, so I had to hire every position. The upper people had moved from Redwood City and Sunnyvale, but essentially, I had to hire a whole crew, from A to Z. And design the product, and..."

cj - A lot of weight on your shoulders...

"And the same chaos continued."

cj - Who was causing all these problems? Upper management? (doh! Its always upper management.)

"Upper management.

.

.

Upper management.

Who knew nothing about the products. I consider myself a business person. Most of these others were administrators. And an administrator is not a business person.

A business person has to have enough knowledge of industry and technology, of human resources, to the market, you name it.

Administrators is a very small part. He was a pure administrator.

After we made the product, we were forced to make, in record time, by the way, we developed the initial product, which was, for the purpose of closed circuit and/or educational markets.

And we developed the first ever high resolution video. Not high resolution by todays standards, but high resolution compared to what some other prior peoples recorders.

VR 70 cameras had a full 80 K resolution. Single headed recorder.

Now, we were.....there was such a fight going on between the money maker company, which was a four headed recorder, same price range that IBM had had.

So we were not permitted to sell the recorder because they were afraid it would cut into sales. You know, just stupid!

This is why IBM didn't participate in the PC, in the way that they should have.The Boca Ratan (?) caused this.

So we were not permitted to continue to push that recorder .We were forced, instead, to come up with a reduced cost version, to try to sell to the consumer market.

Which was too complex for that market, and it really was premature to serve that market.

The VR 5000, never the less.....

End Of Tape 1

(cont)

"nevertheless, Bill Robinson, and he remembers his Super 8 success with Bell and Howell, insisted. Next thing we knew, we had lots of troubles with the product. Then my boss quit, and I became the boss of the consumer and educational.....first I became the boss of that operation, then I reported to the VP of the corporation.

Then he quit. And now, I headed the whole....I was the Group Executive....Group Vice President of Consumer and Education Products. Ampex Service Company.

I couldn't live with it, either. The demands, and the conflicts were such that it....ah.....I had a very good lawyer in the office next to me, and he looked at every one of the contracts.

I was the successor of that neglect.

..

Anyway, I quit. I had no other job. I moved up very rapidly to be a big shot, but all of a sudden, I headed more than half of Ampex....."

cj - You felt like you were the Captain of the Titanic, and everybody was jumping ship...

"That is right. One boss, after another one, quit. And I couldn't get along with...I mean ...the direction was so, so wrong. We were heading for a big iceberg, and nobody would listen to me."

cj - Now thats a pretty big decision, how did the wife take it?

"I made a decision, and that was it. And we had our first long vacation.

I had a boat at the time on Lake Michigan. It took a very long boat ride. Thirty seven foot cruiser. We went all the way to St. Louis, down the Mississippi, and up to St Paul.

And with the kids. And it was of the most wonderful vacations we had."

cj - So you had some boating experience before that?

"I had the boat for several years. This was the first I really had time to use it. Previously, it was kind of short, weekend trips.

cj - Did you have it at the harbor near Hyde Park near downtown Chicago?

"Actually, I had it north of Chicago. I lived in Riverpegmist (???help!)

The harbor I had it in was just north of the city on the Wisconsin border."

cj - Thirty seven feet - thats a big boat!

"Big boat. I took my whole family, and all of our stuff. And you need a big boat on Lake Michigan. Lake Michigan is a vicious lake. Storms can rev up very quickly. And before I left for vacation, I left my resume with a few firms. Before I even left, I was offered a couple of jobs. I was offered a job almost immediately by Motorola."And successfully setup at Whirlpool."

cj - This was about....when - 1956 or later?

"Let see...we are now talking about...this was back in 59. The first job offer I got was from the Chairman of Whirlpool.

Whirlpool, as you know, prior to that, was a appliance supplier to Sears and Roebuck, and it was setup as an independent branch, and became very, very successful.

cj - There still around...

"Thats right! And still successful. Now, they also had several smaller electronic private brand factories, and also making primarily for Sears..color television sets, and the like. And so they offered me to be the company president of, and make me the independent branch in the television/radio electronics field. Having had the first hand experience and spending a lot of time in Japan, and visiting Matisuta (?) Sanyo, Sony, and knowing where they were, and looking at what Whirlpool had, I frankly told the guy: "Alex, thank you very much, but I don't believe its doable.

Had you done it ten years ago, maybe. But right now, they are so far ahead"

And they are so much more efficient then, than the U.S. was. And it was not just mechanization, but it was more efficient.

They had eliminated the traditional division of jobs. You would be surprised how much every line operator did. They were no setup people, there were no technicians. The people on the line knew their equipment, took care of their equipment, and knew how to set it up, how to clean it, how to make sure it was operated in a way that didn't fail."

cj - They had a good training program....

"And a commitment. Anyway, so I didn't take the job. But one of the interesting jobs that came along was....was for General Instrument Corporation. They were looking for somebody at the group ,,,(?)along, so I got this message. I stopped at various harbors and checked messages, someplace in Northern Wisconsin. I took the train to Chicago, and then the train from Chicago to New York, and met with executives there, and they offered me a job! They were in the midst of restructuring."

cj - Sounds familiar...

"Yes, and it sounded interesting, and it was my next job for twenty years."

cj - Theres some stability at last!

"Yes.

cj - General Instruments, do they make test equipment?

"They no longer exist, General Instrument, not Instruments, was lots of things, it was a mini conglomerate. They had lots of technology, and lots of products."

cj They were in Wisconsin somewhere?

"First of all our headquarters was actually in New York City."

cj - You made a big loop then, New York, West Coast, Chicago, and back to New York...

"I moved where the jobs were. I had a couple of opportunities, and they had a bad habit of there of bringing in a new officer level person, essentially to be sort of a tactical troubleshooter, trying to fix problems. So I actually sat through all of the proper meetings, and the then chairman asked me to write a couple of page memo to him. "Now that you have sat thru some meetings, what do you think about us? You have been here long enough to see most of our problems, and not long enough yet to have the prejudices of everyone we have here." Anyway, I wrote him a little note commenting that there are many problems, but two of them are extremely serious. One is the semiconductors, and the other is broadband. And I wouldn't mind heading one of those groups." Anyway, my footnote to the note. The biggest loser has semiconductors. So guess what. I become the group Vice President of semiconductors. The chairman called me in the office and said: "Now, what do you know about semiconductors?" Nothing more than I have been a user of semiconductors for years. I know nothing about how to make them."

cj - This was all just starting to come to the forefront of things...

"Well, actually, it turns out that General Instrument was a leader on MOS technology, which, to them, was new technology. Part of the reason I wanted to join the company because they were really, really, technology leaders, ahead of bigger business people. You know, MOS was just being founded. Fairchild and TI had ignored, because there were lots of problems with that technology."

(CONT-talking MOS technology)

"It was brand new.

And it would have a whole set of problems that the bi-polar guys didn't have to face.

cj - Like shag carpeting and ESD's...

"The whole issue of minor impurities, including water vapor in a system while baking oxide, lead oxide, that was just one of them. So guess what. You know, I am heading the largest loser in the company, a division of minor electronics division, which was the biggest loser, semi metals. Semiconductor components, rectifiers essentially, and semiconductor assemblies, which includes other things, selenium, so....I had to turn the loser into a profit maker."

cj - It seems everywhere you went, people were putting pressure on you to turn around projects!

"Apparently, that's part of my...."

cj - A lot of pressure on you...

"I probably could have done better, but I always managed to get stuck with it somehow. Anyway, I did that for two years, and then the next big issue came up.

The largest subsidiary of my company was General Instrument, Taiwan, which had, at the time, 10,000 employees.

Lots of help.....????(audio dropout-tried EQP-1a-no help)?????.....tube projects too.

You name it.

And I was offered a job to head the Far East group. Which included that plant, included sales offices in Tokyo, and in Hong Kong, in Osaka, and eight plants in Taiwan. My wife was a student of inter-oriental continents, and so on."

cj - Were your children out of the house by then?

"Some were, our youngest one was still with us, and came with us. one of our daughters. She was already....actually, she had just graduated from Junior College.

Anyway, it turned out that the problem there was bigger than I had expected. Two weeks after arriving on the scene, I read on the local English Language newspaper, that the government has decided to close our plant. Because of the labor law and safety and hygiene violations. And nobody notified Felize (?), the guy who was in charge of public relations, to tell me that. I had to read it in the newspapers!

Well, now came the battle, and I had to quickly introduce myself to the new government officials, heads of other American companies....I succeeded in getting a one week delay. And we scrambled to correct the obvious problems. And they were right. No question. The management there had neglected lots of things."

"Ventilation was inadequate in a number of locations. This was all triggered when a couple of girls died. Because of the long history of problems at this plant, kidney failures caused by smokes and other pollutants from the solvents, and the resin smoke from soldering. Things like that. Real causes were....who knows. Fundamentally, we were the largest plant. Anyway, we worked day and night installing ventilation equipment, correcting the labor violations, depending on age, women can work certain number of hours...

We corrected those things, got a weeks delay, had an inspection a week later, passed, got another weeks delay, we had passed ninety percent of the requirements....."

cj - That's a big plant!

"Big plant. Everybody worked virtually 24 hours a day. Without a question, and the productivity of the work force became...."

cj - So bet you did not get much sleep that week?

"That's correct. Anyway, and also, I had trailers, these huge forty foot trailers, of the current product from us. The FCC had

mandated that by a certain date, every television set had to have a UHF tuner. And the principle manufacture of these electric-mechanical tuners was General Instrument Corp. They were manufactured in the plant."

cj - Well, thats a good business...

"Thats right. But because of inadequacies of the product that existed, and because so many of the plant was still not fully...I mean...the processes were not the customer did too much of the inspection, and returned...so these came back....anyway, we got that under control too, you could write a book about that experience, all by itself."

"Subsequently, we penetrated the Japanese market, became, by far, the world's largest supplier of UHF tuners, became "Product Vendor of the Year " from Matuska(sp?), and they were very helpful in helping us to clean up some of the problems that we had. Our employment grew from 10,000, we peaked at 18,000. I became very friendly with the Minister of Affairs, and the Prime Minister of Taiwan."

(note: it was here that I realized that the 670? Big deal! -cj)

cj - Did you learn to speak Taiwanese?

"No, I did not. I tried, but I found that I did not have enough time to learn it."

cj - Being in management, did you miss sitting down at a bench with a soldering iron?

" I still ended up getting right into the guts of the matter. My style was never to sit in a high chair and look down. I mean, I was in the midst of it all. I visited the plants daily...anyway, I did that for three years, and in the meantime, I ended up buying Philco Ford's semiconductor business, and a plant in Bellsong(sp?), which was a very, very good business. General Instrument was also the worlds largest manufacture of rectifiers. We made them by the billions. We bequeathed a method and developed a new way to make it, which made them more reliable than anybody else's. A form of glass encapsulation prior to attachment of the leads. We really had a truly reliable , inexpensive device. And we mechanized that business, gradually reduce...I think we ended up building these rectifiers...that plant used to have, like, 2000 employees, and we made millions a day with maybe, 150. We did a wonderful job of mechanizing it. So I did that for three years, and then I got a big promotion. Now I became the group.....(probably Group Manager-cj) and combined lots of things.

Thats still part of my responsibilities, but now, I also had the rest of the component business, and our military business.....

cj (interrupts) - how long were you in Taiwan before you moved back here...

"this end, still part of my responsibility, now that I had two thirds of the company."

cj - You don't have a lot of free time, I imagine. Did you ever get to see your children?

"Well, I did, and sometimes I wish I had spent more time with them. Fortunately, they have all done well, and there not mad at me, so..."

cj - So now you were back over here, are you still tied in with any of these companies?

"As far as General Instruments is concerned, now I headed all the component business, which included CPR (?) relays, targeting systems, primary radar surveillance systems, and targeting systems for missiles, which was maybe the first passively targeted device. The Navy had put Harpoons on the P-3's, and while there were weapons up there, they also have a very powerful radar system. But they are defenseless, you know, and an anti aircraft missile could find them in a nanosecond."

(note: the P-3 Orion, as many of you know, Lockheed built (MD?) Navy sub finder with a big "stinger coming out the tail, where the antenna sits. They used to circle around here constantly, after a low and slow flight over the pacific, usually Hawaii and back, during the cold war years, making noise (turbo-prop), disrupting AM radio broadcasts, and killing golfers next to 101. - cj)

"So it was our job to....we created our own re-con monopoly. We developed a purely active way, by looking at enemy radar signals, to target the Harpoons. By only missiles. By identifying the track points. And by targeting, so that the Harpoons can go flying up, up until they can take over its own final targeting. That was just one of the things, anyway,.....so I did that...quite a few years, and then, I sort of became an overall guy, and the Executive Vice President of the corporation, and the adviser to the chairman."

"They had some rules. Above a certain age, above sixty five, you couldn't serve in certain capacities. For the last couple of years, I was overall V.P. Anyway, so I did this until the company was sold. Or bought, which was in December of 99. And then, all the top shelf was retired."

"So I was retired. End of December of 99. And then, Frank(?) and I, we founded a company called Manhattan Partners. And went out looking for things to buy."

cj - Turned into a venture capitalist?

"Well, we found that Westinghouse was selling one of their electronics entities, called Contec International.

cj - That is where you are working now?

"No, I was, until December of this year."

cj - Was that broadband stuff?

"Yeah, it was a very small company, roughly a ten million dollar company. Westinghouse had lost thirty million dollars. It provided technical services, the main part of it was repair, and the servicing of cable and satellite receivers, and cable system

power supplies, and satellite system components. And technical advice.

Well, I took over as the CEO.

In debt, losing money...

cj - Did they do any satellite internet connection broadband?

The principle business was fundamentally repairing cable setup parts

cj - There are some talented people in that field...

"Very good people. It was just mis directed. You don't realize how complex those setup boxes are. Overall, they are more complex than a P.C. You have to have several Simultaneous communication systems at different frequencies, and at different modulator speeds, as well as the picture system, as well as everything. They purposely built those to be difficult to find out how it works."

cj - Sanding off the part numbers of the I.C's? Software?

"Yup, but including some hardware, too. Fundamentally, we acquired two additional companies, related to the large one from Motorola. And we sold the company this January for fifty to seventy times of where....."

cj - Miracle worker! Now did you have to learn a lot of legal stuff to make the transition from engineer, to CEO of all these companies?

"Well, I had a good partner, Frank and I, would report every so often, we would work well together most of the time. And I had good people, including legal talent, so its all a question of having the right people, and getting the capital to get the job done."

"Then,... kind of funny, after I was sort of retired from General Instruments in December, 99, Alan Partrikoff(?), who is a venture capitalist, called me. He might have heard....."Um, now that you have some time on your hands, maybe you want to look at something. We have been considering an instrument in a small company in Westchester County. Some ex IBM Ph D's dreamed up some pretty good ideas, and if you could take a look and see if we ought to make an investment..."

"So I went out, spent a couple of days with the Ph.D's, from IBM at that time, and they had some very good ideas. Fundamentally, they had made some inventions of their own, and they had assured me that these were all done after they had switched jobs from IBM, they had cleared this from IBM...anyway, I made a few phone calls, to the rest of the ...(?)and ended up by recommending to Alan that they go ahead and invest."

"Now, it so happens, that in January of 1999, it takes time for the venture guys to get their money together, after their money, they had to get people to put in. They needed a lot of money, and they couldn't meet their payroll for the people at this little company. Well, I asked them how much they need to pay the payroll. They said \$10,000. I gave them \$10,000. It was just an outright investment. And they also invited me to join the board. And the company, Business Week, out of thousands of small companies in the country, found us to be number two, of excellent small companies. Called Pes..a..???"

cj - How do you do this!

"Good luck!"

cj - Being at the right place, at the right time?

"I found myself at the right place, at the right time."

cj - Well, you paid your dues early on there, thats for sure...

"I also worked hard, I mean, a combination of luck and hard work."

cj - So how many things do you have going on now?

"I still do a little bit of consulting."

cj - So you are completely out of General Instruments..

"They were bought from that buyout firm, by Motorola. They are part of Motorola now.

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Oh, I forgot something. I also headed the Broadband Division of G.I., that part of the company as well."

cj - "It would be nice to show my friends some footage of the 670 invent.....(cj reaching for camcorder, the interview is essentially over.)

"People are still using it?" (Rein is referring to the 670)

"Is there something else that is replacing it?"

OK, Tape 2 Side B

Just dingin round, forgot what we have...

Rein:

"People are still using it? (670) Is there something else that is replacing it?"

cj - They have software plug ins, but they don't duplicate the 670.

(cj hands Rein a slide rule)

"I haven't used one of these in ages."

cj - Remember they used to make them out of ivory? You used the slide rule on the 670?

"Yes, I did. I did."

cj - Did you use the tube data sheets on the 670?

"I used tube data sheets. It used to be....RCA published a book of loose leaf service of all of the data sheets. Unfortunately, there were so many moves. I lost a lot of my old stuff. Computers have completely spoiled me.

I have been using a computer instead of this for the past twenty years, or so, its amazing how one gets spoiled.

cj - I see the heaters are biased up on the this B+ supply to avoid cathode stripping...

"Thats the idea..that is right."

cj - You don't recall what kind of capacitors you were using ...

"Most of them, I think, were Spragues. These pots were Allen Bradeley, and those are Davens...."

cj - I notice you have some grounding lugs on these pots...

"As much as noise was always a problem back then...."

cj - Were you in contact with Fairchild when they were doing all that new stuff?

"Yes. As a matter of fact, I met the founders. You see, Sherman actually financed the first group of people, who were the founders of Fairchild Semiconductor, out of his own pocket. Long before the various financial guys came in. I met them at Sherman's apartment. He introduced me to the group at the time."

(note from cj - this "group" than Rein so nonchalantly refers to is probably the "Traitorous Eight", dropouts from the Shockley Regime. Two of the eight, Moore and Noyce, went on to found Intel)

http://en.wikipedia.org/wiki/Traitorous_Eight

cj - There was a big battle going on over who actually came up with the I.C. Fairchild, or T.I.

"I don't think theres any question that both T.I and Fairchild played a role in bipolar integrated circuit development."

cj - Is it fun being a Genius?

"I'm not....."

cj - Did you have time to enjoy music?

"Yeah, I did."

cj - You went through the Swing era...

"I've always liked various types, but I like solo music, good piano concerts come to mind...."

cj - New York is a good place for entertainment...

"Yes it is. I also found that to this date, nobody has done a decent recording of a symphony orchestra. I almost don't like listening to recordings of a live symphony orchestra, because it is so poor compared to the live performance. To this date, our recording path is really miserable. Recordings and reproduction of it. First, when you have so many continuous....(?)...differences.....and all theso much is lost. It is no longer fresh. I'm so critical, that I don't like to listen to it. There is still to be a truly high quality of a large symphony orchestra. We are still trying so hard...to be developed. If you think about it, in 2005, and we have not accomplished this, even though lots of people claimwhen you go and listen to the professional recording, and go and listen to the symphony orchestra, you don't want to listen to the recording."

cj - Irv Saul..(?)

"Yes, he interviewed me a few years ago."

cj - Did you design the faceplate for the 670?

"Yes. Including the original drawings of the chassis. and used Greenlee punches to punch holes in the chassis!"

cj - You need a heavy chassis, this thing weighs 64 pounds!

"Today, it would be done with one quarter the weight. Throw away the power supply, you throw away the power amplifier for the control voltage..."

cj - But it wouldn't sound the same. People buy these darn things, you have all that classic iron.....

"matter of fact, you can make a better power supply..."

cj - What happens to the dynamic range during compression. Do you tend to lose a little high end?

"You don't have to. Maybe you reduce the overall dynamic range by approximately ten to twelve db, this was never intended to be much more than that. Then you creating such distortions..."

cj - If your a good engineer, you don't need all that compression anyway...

"If you actually sat on the recording console, it is still very difficult to follow the music, you see a cymbal crash coming but you're never fast enough. "

cj - How many hours does it take to build a 670?

"The ones that I manufacture by hand myself, oh, it takes....probably took me about three or four days...."

cj - wow, thats pretty fast!

"...after the initial chassis. I had probably manufactured the chassis before then....I only made it with two Greenlee punches."

cj - Now did you start off with a block diagram of what you want, or just start drawing the schematic from the git go?

"Well, I had the block diagram pretty much in my head. The block diagram for this is extremely simple. Audio amp, control voltage generator, and the power supply. Very simple block."

cj - Did you do any radio design? Or did you go straight into audio?

"As a matter of fact, when I worked for the U.S. Military, and at the War Trials, as part of my income, I did build radios. I actually built some radios and I sold them..... from scratch, you know, anyway, to make money, because we were starving."

cj - Now this control amp does not have a regulated voltage on it, is there a reason that you don't need to have.....

"You don't have to have it regulated, simply because it's gain is controlled by the feedback. So any changes in voltage will not change it's gain. So it doesn't require regulation."

cj - Now did these sell pretty well after you started putting them on the market?

"I don't think they sold very well."

cj - They probably sold for a lot of money back then, maybe five or six thousand?

"No, no, those sold for around five hundred dollars."

cj - And you know these sell for thirty thousand dollars, remember, I told you that?

"Thats what you told me. Hard to believe."

cj - So Les Paul never worked on this?

"No, he had nothing to do with it. Anyway, he bought one of them."

cj - Did you ever go to Van Gelder's studio and hang out?

"Sure. As a matter of fact, my first involvement, really, with equipment and industry, was....I.....people started to use the Telefunken microphone, the Neumann U47 microphone, and I noticed that they were doing.....at Gotham....the distortion products were just too high. I was a little bit surprised, because those microphones were never intended to be used the way they are used here in the United States. It was always used as a single, or two microphones, far away from the source, so the sound pressure levels were actually very low. U.S. applications, people used it relatively close to an instrument, or a performer. And in overload conditions. And so, one of my early moneymakers was I re-designed the circuits inside. Originally, it was set up as a pentode amplifier, and I changed it to a triode, cathode follower. Because the gain was not required in the U.S studios. So it was now an essentially a zero gain impedance converter. Now the distortion products, for all practical purposes, disappears. It was now useful."

So for a while, while at Gotham, we modified U-47's for twenty bucks a piece, or something like that. I personally took em apart, and adjusted the gain, and so on, and later, I think, "..?..)...., my partners, and others, showed them how to do it. I personally must have modified several dozen of U-47's. So it's possible that they thought it would be ..?.. change those circuits."

cj - So you wired the screen to the plate...

"That is right. And I changed the circuit from being plate loaded, to cathode loaded."

cj - People were putting those right over the piano...

"Oh, and sometimes they would put it right in front of a fairly loud instrument. Or a loud singer. Also, because of some of the distortion products of the transformer, so the pentode, being a high impedance source, really didn't do much to deal with some of the iron distortion products of the transformer. so a cathode follower, having a lower impedance, improved that as well."

(back to some 670 stuff)

cj - Did you ever talk to any of the transformer engineers...

"Never did. These are stock transformers...., so I never talked to anyone about modifying them, I just looked for components that could do the job."

cj - This 670 can probably drive a pretty long transmission line, with this output here....

"If you had to run a line down the hill, you shouldn't have any trouble at all. Its well balanced."

cj - You didn't have a way to measure the rise time of your control voltage...

"Within the limits of the oscilloscope. I could not measure it precisely, but I could get a pretty good idea. I calculated it, then I listened to the effects on a particular recording."

cj - You could calculate the amplification factor of this whole voltage amp...

"Easy enough to know what the source impedance was, at the various frequencies, so that's easy to measure them. The scopes didn't have the bandwidth that they have today, but they still had a couple of megahertz, which was adequate response.

As a matter of fact, I didn't even have that, what I had is....the test equipment I had at the time was tube equipment that I put together myself."

(cont) last installment-Rein was getting a bit antsy, later, I found out that his silent cell alarm had gone off. His ride was on the way to pick him up, and he needed to take care of things. Never the less, he did not cut me off..

cj - These are nice big VU meters...

"Those are Westons. Very specific dynamics."

cj - Nice grounding, plenty of big buss wires...

"One of technicians that worked with me at the time, Alexandrovich?"

(note: George Alexandrovich, His name is seen on the cover page of a 670 manual that is floating around the web. George and Irv might be two great leads for further info, if so inclined...)

"He may have been the guy who did some of the detailed layout, with Irving Saul. Irving Saul was the engineer....."

cj - Did you have any problems with audio hum, having that big power transformer in the proximity....

"No. First of all, everything is balanced. The two guys who have something to do with the detailed layout are Irving Saul and Alexandrovich. I think he was of Russian orientation. Have you heard of Dave McNight?"

cj - Was he on the 670?

"No, no, not 670, but he was part of my team at Ampex, but he was quite an activist at AES for awhile."

cj - Here is an Altec compressor, and.....

"That was one of the units that didn't do the job....."

cj - But this Langevin Leveline.....

That's right, these are the ones that kind of prompted me to design this one because the distortions that they caused."

cj - It looks like you pulled out all the stops when you designed this thing, it was quality from the git go....

"The point was that the recording art needed to be improved. You don't go in with a hammer and chisel, you know, when you need a surgical knife!"

cj - Thank You very much!

cj - You know the Beatles, right?

"Yeah....."

cj - They used the Fairchild on a lot of their stuff...

"They did! How about that! Ha ha! Kind of funny, using something that I did."

K, the X files, the trailer, the "previously unreleased material, the "bonus tracs" ..the whatever.:

cj - Fifty plus years! (670)

Rein:"Fifty plus years now. Thats something I've learned about designing products, is that you have to thoroughly understand its use. And most engineers do a lousy job. Not a sufficient understanding of its use. These guys coming out of colleges, it takes them a loooong time. And most companies fail, simply because they ignore the importance of the final one. I can remember times when having to physically have to actually do a lobotomy and find all the problems with things. Things have to be looked at carefully, better than one can postulate. You can only postulate a project so much."

cj - Have you heard of Tom Dowd?

"Oh, yes, I've heard of Tm Dowd.

Tom Dowd and Ed Ecky(?), were the guys at Capitol Rrecords.

I spent time with them."

(did he mean Atlantic? Or did Dowd work for Capitol for a while?)

"Actually, I built for them...one of the things I designed was a one hundred and fifty watt power amplifier. ESB-150. And Ed Ecky was Chief Engineer at Capitol Records. This was in the early fifties."

OK, thats all I got.

Interesting to note a possible signal chain, just for kicks,

Miles Davis>Van Gelder Studios>Rein Narma modded U-47, Rein Narma mixing console, Rein Narma cutter head amp developed at Fairchild, Rein Narm stereo lathe developed at Fairchild, so in theory, a classic from Blue Note may very well have been done on a total Rein Narma signal chain?