

TRANSISTOR MUSEUM™
THE HISTORY OF TRANSISTORS - VOL 2
THE STORY OF THE CK722

THE NEW ADVENTURES OF CARL & JERRY
The Boys Experiment With a CK722 - Their First Transistor
And Find a Cure For Spring Fever

DEDICATIONS

This story is a tribute to two men who will long be remembered for their historic and significant contributions to the world of electronics in the 1950s and 1960s. If you were an electronics engineer, researcher, scientist, hobbyist or experimenter at any time over the past 60 years, then you likely have been influenced by these extraordinary men:

Norman B. Krim: Norm Krim was the "Father of the CK722" transistor. He was the Vice President of the Raytheon Receiving Tube in the early 1950s and positioned the company to take an early and significant lead in the manufacture of germanium junction transistors. The mythical CK722 transistor was the result of an inspired program established by Norm to market hundreds of thousands of sub-performing hearing aid transistors to young hobbyists. Many of the talented electronics professionals who have been responsible for the tremendous rise of the electronics industry over the past five decades can still remember the absolute delight of hearing a local radio station coming through on that newly constructed radio, powered by a gleaming, bright blue CK722 transistor.

John T. Frye: When the Popular Electronics magazine first appeared in the mid 1950's, one of the most widely read and eagerly awaited features was the series entitled "Carl & Jerry", authored by Mr. John T. Frye. For over a decade, month after month, Mr. Frye entertained his readers with the continuing adventures of the two young friends, Carl and Jerry, as they learned and experimented with electronics technology, often using their skills to overcome the daily challenges of growing up in a small town. Although the "boys" never came across one of Norm Krim's CK722 transistors in their original adventures, it could have happened. I have tried to be historically accurate and also true to the style created by Mr. Frye almost 60 years ago. This New Adventure is offered with the greatest respect for the historic work of Norman Krim and John Frye.

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Warm weather was just beginning to make its appearance. March had been unusually warm this year - it seemed likely that 1953 would provide a generous supply of sunny days. As a result of the great weather, there was a major outbreak of spring fever at the junior high school. Carl was having an even harder time than usual paying attention to the classroom discussions. As far as he was concerned, there were many more interesting things going on outside the school building and he was anxious for the school day to end. Carl looked over at his friend Jerry, who was tapping at his watch, apparently in an effort to accelerate the "minute" hand and thus shorten the last class of the day.

Finally the school bell rang. The boys jumped up out of their chairs and ran as quickly as the teacher would allow out the door and down the main school steps. Without speaking, they continued running and managed to maintain a pretty good pace all the way to Jerry's house. Although out of breath from running, both boys called out at the same time, "Was it in the mail today?" Jerry's mom had known exactly what to expect when she heard the front door swing open just a few seconds earlier. Every day for the past two weeks, it had been the same routine. The boys would come home directly from school, head straight for the hall table where she kept the mail delivered that day, and call out to her, hoping that the package they had ordered had finally arrived. Today was the day. "Finally!", said Carl. "I was beginning to think that this transistor stuff was a hoax."

The boys thanked Jerry's mom, quickly took the package and headed off to the basement workshop. "Transistors are not a hoax", said Jerry, " and after we've had some time to experiment with what's in this package, I think you'll see why I've been so excited about these new devices." Ever since Jerry had received his February issue of Radio and Television News magazine, he had been talking about transistors with such enthusiasm, that even Carl, who usually reserved this level of excitement for Whitey Ford and the Yankees, was eagerly awaiting the chance to actually see and touch one of these little "gems".

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Jerry set the package down on the workbench, took out his pocket knife and carefully removed the band of brown shipping tape which had been used to seal the top of the box. The address label on the package had a preprinted return address area which read:

Raytheon Manufacturing Company
Receiving and Cathode Ray Tube Operations
55 Chapel St
Newton, Massachusetts
Attn: Mr. Frank Dukat

Jerry carefully emptied out the contents of the package. There appeared to be three items carefully nestled in the packing material. The first two items were pieces of paper, which Jerry examined quickly and then passed over to Carl. While Jerry was fiddling with the third item in the box, Carl announced that the papers were (1) A handwritten note to the boys from a Mr. Frank Dukat at Raytheon and (2) What appeared to be a data sheet for a CK722 transistor. "We'll need to use that data sheet soon", said Jerry, "so put it away in a safe place." "What does the note say?" Here is the text of the note that Carl read to Jerry:

Hello Boys,

My name is Frank Dukat. I am the Product Manager for transistors at the Raytheon Company. I'm writing this note at the request of my boss, Mr. Norman Krim, who is the vice-president of the Raytheon Receiving Tube Division in Newton Massachusetts. He received your letter last month which contained \$7.60 and a request to send you a new Raytheon CK722 germanium transistor. Mr. Krim and I are delighted that young experimenters like you are interested in this exciting new technology. You'll find a brand new CK722 contained in this package, along with a data sheet, which should help understand how to use the device. We've also returned your money. Raytheon is committed to supporting active amateur and hobbyist interest in the CK722 and other Raytheon transistors - please tell your friends about Raytheon transistors and look forward to many articles in the next few months describing the exciting uses for these new devices. Thanks again, and good luck with your CK722!

Regards, Frank Dukat

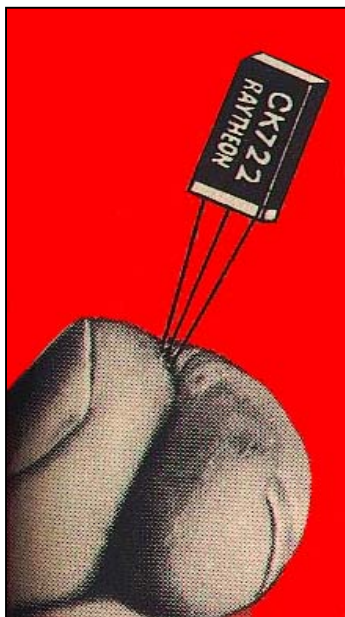
March 7th, 1953

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Although the boys hadn't seen the money at first, a more thorough examination of the packing material revealed a small envelope which contained the \$7.60 they had sent to Raytheon last month. "This is really neat", said Carl. "You remember how hard we worked to make that money. We must have cut all the lawns in town!" Jerry was already opening the container which held the CK722. The transistor had been packaged in the familiar red, white and blue Raytheon cardboard carton which was commonly used to hold Raytheon tubes. Jerry carefully removed the cherished artifact and exclaimed, "Isn't this amazing? No glass tube to break, and no filament to draw excessive current. Just look how small it is!" If it hadn't been for that article in the February 1953 issue of Radio and Television News magazine by Mr. Robert Dixon from Raytheon, the boys would have been uncertain about how to use a transistor in an actual radio circuit. Now, they were ready - they had the plans and they had a wonderful new CK722 transistor.



**"Isn't this amazing?"
Jerry lifted aloft their
new treasure - a
Raytheon CK722!**

The boys had been gathering the parts together to build this radio ever since they had seen the article. Fortunately, except for the CK722 germanium junction transistor, all the other components were standard devices and the boys had accumulated a junkbox full of these parts from their many past experiments. In fact, they had been so eager to build this radio that most of the assembly had already been completed, lacking only the transistor. Mr. Robert Dixon had designed the radio to be built with either one or two transistors, and since \$7.60 was quite a bit of money to hobbyists (especially young ones), the boys had decided to build the one transistor version.

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"Let's get started with soldering the transistor leads into the circuit", said Carl - "I want to see what happens when we hook up that three volt battery!" "By the way. Are you sure three volts is enough? Maybe it was a mistake in the article. All our other radios use more voltage." Jerry rolled his eyes. How many times would he have to explain the "new-fangled" transistor technology to Carl? "Three volts should be just fine. These transistors are not at all like tubes', Jerry explained patiently. "Ok!", responded Carl. " Let's get started - the soldering iron is quite hot now and we should be able to get this done right away." Jerry was just about to touch the heated tip of the soldering iron to one of the leads of the transistor, when he had a thought about something he vaguely remembered reading. "You know, I think what we should do first is solder a subminiature tube socket in place, where the CK722 connections should be made. I remember reading that transistors can easily be damaged by heat. So let's solder the socket first and then we can insert the CK722 without damage." The boys had scavenged an old damaged Zenith hearing aid, and had saved most of the circuitry to use in other projects. The Zenith "Royal" hearing aid used sockets for the subminiature tubes and these sockets were also an exact fit for the CK722 leads.

Jerry carefully soldered the three connections of the tube socket into place. "Good job, Jerry", said Carl. "Now, let's plug in the CK722 and see what happens." They both studied the transistor carefully and referred to both the spec sheet and the schematic in the article. Carl spoke first. "Which way does it go?' Jerry answered right away. "Carl! See that little red dot on the side of the CK722? That's how you locate the proper polarity of the transistor. If we get this wrong, we could damage the germanium pellet inside, so let's just double-check it." Jerry took another look at the CK722 spec sheet. The red dot was shown quite clearly as marking lead #1. He said to Carl, "The red dot pinpoints the transistor lead called a collector. This is similar to the plate connection in a vacuum tube circuit. The collector attaches directly to the earphones. It is the output lead of the CK722 in this circuit." Carl was impressed. "I see you've been doing your homework on this! You've learned all the special terms and everything!"

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Jerry didn't reply, but he was pleased that Carl noticed how much he had read about transistors. This really was exciting stuff, and he wanted to be up to date. "Done!", exclaimed Jerry as he slid the CK722 easily into the tube socket. "C'mon Jerry", piped in Carl. "Let's connect the battery and see what happens." "Slow down just a little", said Jerry. "We have to be careful about the battery polarity, too. If we connect it backwards, that could also destroy the transistor." "I don't know about all this", remarked Carl excitedly. "How can something this fragile ever be a replacement for a vacuum tube? We never have had to take so many precautions before."

Jerry ignored these last remarks and double checked the circuitry and wires and battery, just to confirm that all was as it should be. Satisfied, he was just about to connect the positive lead of the battery when a voice filtered down the stairs. It was Mrs. Butler - Jerry's mom. "Dinner is on the table, boys". "Carl, I spoke with your mother and she said it was ok for you to eat with us tonight. Please wash up now and come upstairs." There was nothing to do but to go upstairs right away - the excitement of the radio would have to wait just a little longer.

Carl's table manners were even worse than usual at dinner. He was still very excited about the events of the day and couldn't stop talking about it, even with his mouth full of Mrs. Butler's excellent meatloaf. After three helpings of the main course, followed by cherry pie with vanilla ice cream, Carl thanked Jerry's mom for the dinner and nodded excitedly to Jerry and pointed to the basement door. They hurried downstairs and stood anxiously around the workbench. Jerry picked up the earphones attached to the radio, put them to his ears, and connected the battery. There was a sharp "pop" when the battery made contact, but then silence. "WHAT DO YOUR HEAR?", Carl almost shouted in his excitement. "Any sounds?" Jerry turned the knob attached to the tuning capacitor, and adjusted it up and down the frequency range. He thought he heard music and tried to fine tune the adjustment, then he said "There is something coming through, but it isn't quite loud enough to understand." "What could be wrong?", Carl wanted to know. "Wait! We didn't connect the antenna and ground wires yet. That's got to be the problem." Jerry suspected that Carl was right. This simple radio really needed these external connections in order to produce usable volume.

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Long ago, Jerry (with Carl's help) had built and mounted an antenna on the roof and there was a wire coming in through the basement window. There was also a ground wire coming in through the same window, and connected to an outside water pipe. "Quick, Carl. Let's attach the antenna and ground wires to the radio." A minute later, the sounds of Patti Page singing "The Doggie in the Window" were playing loudly through the earphones. Carl and Jerry exchanged smiles as they realized the radio was working fine and was loud enough to be heard, even with the earphones lying on the workbench. "It works', they both yelled at the same time.

Over the next few weeks, the boys spent every available minute tinkering with the CK722 radio. They had their best times, of course, in the evenings when the reception was strongest and when they were able to spend uninterrupted hours. By early May, the boys were quite expert at operating the new radio. The device was so light weight and portable that Carl had actually taken it to his house on several occasions, and since he too had an outdoor antenna and ground connection, reception was quite strong in his room. School work was definitely NOT progressing as smoothly. The weather continued to improve at an unexpected pace, with very mild almost " balmy" afternoons and very little rain. This was almost too much for Carl, as he sat distractedly in his afternoon classes, glancing wistfully out the windows at the brilliant sunshine and thinking about the Yankees baseball games which were being broadcast on the local radio station, but which would be in the late innings by the time he got home from school.

On one such Friday afternoon, in the middle on May, Carl and Jerry were down in the basement listening, as usual, to the CK722 radio. Carl was complaining about school and how he really hated missing the afternoon baseball games. Jerry had never been a sports fan. In fact, he thought the whole idea of sports was a total waste of time, but he did somewhat sympathize with Carl's very bad case of spring fever. He had been mulling over a plan recently and decided that now was the time to mention it. " Carl. You know we still have almost a month of school to go?" " Yes, I know", moaned Carl. Jerry continued, "Well, I have a plan that might help us get through the long afternoons. Would you like to hear it ?" " Yes, I sure would, " Carl replied. "Your plans are usually good ones."

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Jerry rolled out his plan as follows : " You know how we have that big metal radiator next to our seats at school, and how we also sit next to a row of windows ? Well, I was thinking that a wire hanging out of one of the windows would make a great antenna and that a wire connected to the unpainted part of a radiator would make an excellent ground connection. All we would need is a small portable radio and we could listen to our hearts content during the boring parts of class. What do you think? " It only took Carl a few seconds to see where Jerry was leading with his plan, but when he did, the response was a loud yell. "Yahoo," exclaimed Carl. " Why didn't I think of that, and what's our next step?"

Jerry had actually been giving this plan quite a bit of thought and had already done some advance work. "Well," he said, "the way I see it, our most important task is to disguise the CK722 radio so that the teacher won't suspect what we're up to. If we can do that, then we'll be home free." Carl suspected that Jerry was right. In their class at school, the teacher allowed them all to have a study period for the last hour of each day. That was the time to use the radio. The Yankees would be just starting and Carl figured he could do his studying and listen to the game at the same time. "Ok, how do we do that?", Carl wanted to know. Jerry replied, "I went down to the school library during lunch yesterday and looked through the big box of used books. You know the ones they are going to throw out if no one is interested in taking the books home. Well, I picked out the biggest, thickest book I could find. It is The Collected Works of William Shakespeare. This thing is over five inches thick, which ought to be more than deep enough for our purposes." Carl immediately knew what Jerry was planning. He said, "Let's get busy and cut out a space large enough through the center of the pages so that our radio will just drop right in. If we leave the covers on the book, and just enough of the outer edges of the pages so no one can see inside, then the CK722 radio will never be discovered."

The boys had all weekend to work on their new project, which, as it turns out, was a good thing because the chore was a little tougher than they had initially thought. Finally, by using a variety of cutting devices and a lot of patience, a cut-out had been formed down through the pages which was large enough for the radio to drop right in. It was a simple matter then to close the top cover for disguise when the radio was not on use, and also to lift the cover in order to adjust the tuning when the radio was in use. The wires for the antenna, ground and earphones could be brought out through a small hole drilled up from the bottom of the pages.

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Monday was the big day. Carl had "volunteered" to try out their new project first. He really wanted to hear the ball game which was scheduled for that afternoon, starting at 1PM. "It's gonna be great", he said. "Whitey Ford has already won 8 games, which means he might win 20 this season if he keeps it up, and he's pitching today against Cleveland." Jerry was more than happy to let Carl try the radio first in their class this afternoon. All went smoothly. In fact there was an unexpected bonus to their project. The teacher noticed the thick book on Shakespeare that Carl was carrying, and he was so encouraged to see Carl's sudden and unexpected interest in great literature that he promised Carl extra credit on his otherwise questionable grade in English on the next report card if Carl would spend at least an hour reading from the book during the afternoon study time. Carl assured the teacher that he would be more than happy to spend time with Shakespeare each and every afternoon!

The remaining weeks of the school year seemed to fly by. Carl and Jerry could be found sitting next to each other in the afternoon study area, right next to the radiators and large windows. If someone had bothered to look closely, they might have seen several wires extended from a large book on Carl's desk. But no one noticed, and the boys were able to spend quite a few uninterrupted hours with Shakespeare that spring. Spring fever was gone! Carl was able to listen in on one of the most exciting baseball seasons ever, with the Yankees winning 99 games and finally beating the Brooklyn Dodgers in a 4-2 world series. Whitey Ford finished the season with 18 wins and a young player named Mickey Mantle was struggling through a "bad streak". On occasion, when Jerry was able to convince Carl to share the radio, he would open the front cover to the book and change the channel on the radio to a station that broadcast music and news. Songs by Perry Como, Tony Bennett and Eddie Fischer were his favorites. Occasionally, Jerry would get carried away with a song like "Don't Let the Stars Get in Your Eyes" and Carl would have to "poke" him when he started whistling along with the melody.

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Many years later, after a long separation, Carl Anderson and Jerry Butler would meet again. After graduating from Parvoo University, they had parted amicably when their careers took them to different companies and different cities. On reminiscing about the "good old" days, they both agreed that of all the great times and adventures they shared when they were growing up, their first transistor radio, built back in 1953 with a single, wonderful Raytheon CK722 transistor, brought back the fondest memories. It was a time when all things seemed possible and when, for only \$7.60, they could build a marvelous radio that connected them directly to the rest of the world and to the future.



WHAT COLOR WAS YOUR CK722?

The first CK722 transistors developed by Norman Krim and his team at Raytheon appeared in early 1953, and used a black epoxy case (at right above). By 1956, a spectacular iridescent blue painted metal case was used, which lasted until the early 1960s. The last case type was silver metal. Carl and Jerry's CK722 would have been the early black epoxy type. Do you remember your first CK722?