IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MARYLAND

Technograph Printed Circuits, Ltd.
And
Technograph Printed Electronics, Inc.

Vs. No. 11421 Civil

Bendix Aviation Corporation

Transcript of Proceedings Before Hon. R. Dorsey Watkins, Judge

Volume: 22 Date: November 21, 1961 Pages: 2836 to 2933

Frank Figiel
Official Reporter
520 Post Office Building
BALTIMORE 2, MARYLAND
Lexington 9-4103

I N D E X[1]

Witness	Direct	Cross	Re-Direct	Re-Cross
	2838			

E X H I B I T S

Defendant's Number		In Evid.
459.	A folder containing samples of Beck Process	2884
460.	A compilation of documents certified by the Signal Corps	2889
461.	A compilation of documents certified by the Signal Corps	2894
462.	TRE Technical Note No. 36	2932

IN THE UNITED STATES DISTRICT COURT

[1] NLB 2836 - Patent: Auto- Sembly

FOR THE DISTRICT OF MARYLAND

Technograph Printed Circuits, Ltd.)
and)
Technograph Printed Electronics, Inc.)
)
vs.) No. 11421 Civil
)
Bendix Aviation Corporation)

Baltimore, Maryland

November 21, 1961

The above entitled case was continued for trial before His Honor, R. Dorsey Watkins at 10 o'clock a.m.

A P P E A R A N C E S

For the Plaintiffs:

John W. Avirett, 2d
Walter J. Blenko
Walter J. Blenko, Jr.

For the Defendant:

Benjamin C. Howard
Harold J. Birch
Edward J. Irons

P R O C E E D I N G S

THE COURT: Good morning.
Mr. Birch?
MR. BIRCH: The defendant calls Mr. S. F. Danko

THEREUPON:

STANISLAUS F. DANKO
was called as a witness for and on behalf of the defendant, and, having been first duly sworn, testified as follows:

THE CLERK: Will you state your full name, please?
THE WITNESS: Stanislaus F. Danko.

THE CLERK: Please have a seat there.

DIRECT EXAMINATION

BY MR. BIRCH:

Q Mr. Danko, I note, preliminarily, that you have a briefcase. It is certainly fully satisfactory to defendants if you employ any notes which you have made which will help you in your testimony. I recognize that you are here in somewhat of an unusual position of having two attorneys to question you who aren't at all sure what you are going to say, and you are sitting up there without any real knowledge of what you are going to be asked by us. So, if you have anything that will help you in your testimony, by all means use it.

THE COURT: We can't get sex, but we can get drama in the case, anyway.

(Laughter)

Q Will you please state your address, Mr. Danko?

A 306 Victor Place, Neptune, New Jersey.

Q By whom are you employed?

A The United States Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey.

Q How long have you been employed by the Signal Corps?

A 21 years plus.

Q Have you ever had any other employment other than at the Signal Corps?

A Yes.

About two years, after college graduation, with the Brooklyn Union Gas Company.

Q Will you please, at this point, give us your educational background?

A I have a Bachelor of Science Degree in electrical engineering from the Cooper Institute of Technology in 1937. I have taken several courses in statistical analysis and other subjects in Rutgers and the Moorse School of Engineering, University of Pennsylvania.

Q Would you please tell us what your duties and responsibilities were in the position you held with the Gas Company you have identified prior to going to work for the Signal Corps?

A Yes, sir. I was what they call a flue gas analyst.

Q And as a flue gas analyst, did you do anything other than analyze flue gases?

A Essentially I analyzed flue gases, and did checks on the proper operation of electronic controls relating to gas, large volume gas appliances.

Q So if we are understanding of what you have said, your duties with this company were primarily of an analytical fashion and on the side you had something to do with the equipment you employed for analysis; is that correct?

A Yes.

Q At what date did you join the Signal Corps?

A August, 1940.

Q August 1940?

A Yes.

Q Will you start at that date, please, and detail your duties and responsibilities with the Corps up to this date?

A From August, 1940, until July, 1946, I was employed in what was then called an inspection laboratory of the Signal Corps, located in Philadelphia.

Our object at that time, during the wartime, was to test, evaluate, and generally pass upon the quality of war material being procured by the Signal Corps.

This included anything from vacuum tubes to radar

sets.

If I may perhaps elaborated briefly, we were essentially a monitoring laboratory, to see that government contractors did have equipment that was properly calibrated, and that the quality of material that was being submitted was in accordance with specifications, particularly where there were some problems between a field inspector and a manufacturer, some problems possibly arising from borderline cases of specification adherents, and similar cases of that, where an objective laboratory would be required to resolve some problems between the contractor and the field inspector.

Q Did your duties in this laboratory involve electrical circuitry?

A Oh, yes. It was primarily an electronics laboratory, but it did, of course, include test and evaluation of accessory materials, related to electronic equipment, with such mundane things as pliers, the hardness of pliers, which would come under scrutiny, the hardness test might be questioned in the field, for example. It was a rather delicate test sometimes, and it was necessary to calibrate. And we would be, if I may use the expression, the judge and jury that would pass upon the adequacy of the contractor's hardness test, for example.

It was essentially an electronics laboratory. We were fully equipped from an electronic point of view, but we

did have a chemistry group in there and a mechanical group, and such things, for example, you wouldn't expect to find in a laboratory, such as Johansen gauges, for example, a mechanical type for measuring mechanical dimensions accurately, which would be in the laboratory.

Q During that period, from August, 1940, through July of 1946, when you were at the Inspection Laboratory in Philadelphia, did you encounter anything which you would now consider as a printed circuit?

A I would have to say no, sir.

Q So that at the time you left the Inspection Laboratory and went to the Signal Corps in the Fort Monmouth area, you had not yet encountered anything in the field of printed circuitry?

A That's right.

Q Will you start with July, 1946 then, and detail your duties and responsibilities at the Signal Corps Laboratory at Fort Monmouth?

A The Inspection Laboratories functioned having essentially been dissolved by termination of the war situation. I was offered a position at the Fort Monmouth laboratory, which after some consideration, I accepted.

I reported to Fort Monmouth about that time, and I was immediately assigned duties that related to miscellaneous components testing, it was called.

This, once again, was a test and evaluation group. But whereas, previously I was concerned with evaluation of contractor products, being procured for the war machine, so to speak, here I was concerned more with test and evaluation from a research and development point of view. This was a research and development laboratory, so the products that came under my scrutiny were those that came from our formal contractual program with industry, institutions and the like, and these might include, for example, newly developed switches, and I might, at this point, inject the fact that among the items that were assigned to me at that time, or shortly thereafter, shortly after I assumed the duties, was the field then called printed circuits.

Q Do you recall the precise or approximate date when this assignment in the field of printed circuitry occurred?

A The active interest of the Signal Corps, and this I got as a direct communication from Mr. Abramson, was in the spring of 1946. This was before I arrived.

Q Let's develop that for a moment.

Who is Mr. Abramson?

A Mr. Abramson at that time was the assistant section chief of the component section. His supervisor was Mr. Bowen.

Q You have stated that you got certain information by direct communication from Mr. Abramson. Will you explain what you mean by that?

A Prior to coming here, I had tried to establish from him, since he was the prime, so to speak, the pioneer if I may use that word, in the Signal Corps interest first become documented, and he told me that April, 1946, was the period when the Signal Corps interest was aroused in printed circuitry, because of an article by Centralab, Division of Globe Union, the officer of which specifically was Mr. Khouri.

Q Did you become familiar with the Khouri article or have you since become familiar with it?

A I am sure I have read it subsequently. Perhaps I am getting ahead of my story, but I had subsequent reason to thoroughly familiarize myself with the art, from its historical beginning, as it existed in the literature.

However, coming back to the question you asked me, when did I first get my assignment of printed circuitry, it was shortly after I assumed my duties. These were in July, and I would say that within a few months, after I had settled down, so to speak, that printed circuitry was assigned to me as an activity for test evaluation.

Q With whom were you working during this period, Mr. Danko?

A Above me?

Q Above and/or below.

A Below me?

THE COURT: And/or with.

Q And/or with, yes.

(Laughter)

A I had about five engineering and technician personnel under me, who actually performed various chores related to testing and evaluation.

My superior in the performance test section was a Mr. Child.

Q C-h-i-l-d?

A C-h-i-l-d.

THE COURT: What was your rank, or what was your title?

THE WITNESS: Well, here I am confounded by the perhaps Civil Service titles that I have enjoyed, that I question.

I would generally categorize it as engineer, and then they had several parenthetical titles that went with it. I would reply by saying radio engineer.

Q What relationship, if any, did you have professionally with Mr. Lanzalotti at that time?

A I did not know Mr. Lanzalotti at that time.

Q When did he enter the work, Mr. Danko?

A Well, in my subsequent reassignment to the Component Parts Section, which Mr. Abramson was assistant chief, at the time that we are speaking of, 1946, I was still with the

Performance Test Section.

Q I believe we had developed that you had five engineers or technical people under you, and that Mr. Child was your supervisor?

A Yes.

Q And the Court asked you the other possible dimension, who was on the same level with you at the time, if any?

A We had other test groups, I identified our test group as the miscellaneous test group, then a resistor group, a transformer group, electro-mechanical group.

Q Are we to understand by that that in each of those groups there would be an engineer comparable to your position in that group?

A Right.

Q Will you tell us what you did in the field of printed circuitry in your first assignment beginning sometime shortly after your transfer in July of 1946 up to the point where you proceeded to your next assignment, that is the group headed up by Mr. Abramson?

A Well, I was the recipient of models, samples, and so on, for purpose of running electrical tests and getting data, interpreting this data, and sending it back to the Research and Development engineer.

With regard to this specific activity we are con-

cerned with, namely printed circuits, the engineer was Mr. Prieble, and he, at that time, worked under Mr. Abramson in this other components section.

And, as I recall, we did not have much in the way of models to actually evaluate during this period that I was in the test section, I would estimate there were perhaps three or four occasions when material was submitted to us within this broad definition of printed circuit, for purposes of evaluation.

I distinctly remember some Centralab units that came to us for check out, so to speak, to get data, which we did, and we supplied to Mr. Prieble.

Q Can you tell us what the Centralab models were, how they were produced and what they look like?

A As I recall, these were Steatite type based, silver deposited, ink composition, resistor type, capacitor type of structure which Centralab has marketed I think since.

Q Would this be a structure similar to that employed by the Bureau of Standards in the proximity fuse?

A The technique was the same.

` Q What other models can you recall and identify?

A Well, I have difficulty recalling these, but I would like to generally characterize the effort as fairly small compared to the other items that I was testing. I might also mention that as the responsible test engineer for

the Components Section, that I did have transmitted to me, periodically, all research and development reports that related to my particular field of activity, that is to printed circuit activity, for example, and switches, and other miscellaneous electronic devices.

Q As I understand you, then, you do not – perhaps I should ask you more specifically, do you recall the nature of any of these other models other than the Centralab type product?

A There may have been some conductivity measurements of silver deposited on Steatite. I believe there were available some duPont samples of a multi-layering type,

as a result of some war effort on the development of capacitors by a silver deposit technique.

I feel that we possibly may have made some conductivity measurements on such conductor lines.

Q Would it be fair to state that in your activity you had not yet encountered a printed circuit made by etching?

A No.

Q You had not?

A No.

Q Probably before we go any further, Mr. Danko, it might be helpful to counsel and to the Court if you would define to us, with the parameter that you can, a printed circuit.

What do you consider a printed circuit to be?

A Well, I am embarrassed to this extent, that there is a formal definition of a printed circuit, which exists in a military standard. The definition was arrived at through considerable wear and tear on the people involved, and considerable tears, too, I think, but it finally has been hammered down as a formal definition. So, I feel that I possibly may be doing – not giving you the formal definition of printed circuit, but, informally, it seems to be the contrary, I would venture that a printed circuit, in my mind, is an assembly consisting of two dimensional interconnecting harnesses with components deposited in situ, or as attached components, this is without trying to define what this interconnecting harness is. It is a broad generalization.

Q By interconnecting harness you mean a network of conductors of some type?

A Yes, the equivalent of what we would call hookup wires in conventional construction. It is the medium for connecting one electronic component to another.

Q You have mentioned components which are attached or deposited in conjunction with the harness or conductive network, by an in situ component, what do you mean precisely?

A One that is deposited in place on the printed circuit chassis and is not fabricated off the premises, so to speak, and subsequently brought into the environment of the

printed circuit.

Q And by being fabricated on the chassis do you mean produced by a printing technique or something similar to that?

A By any technique.

Q By any technique?

A Yes.

Q Then the converse, I assume from your testimony, of an off the premises component, would be what?

A Well, I would still characterize that as printed circuit, because I said that was a broad definition. Now, as to whether you want to get into the finer details of whether a component is in situ and deposited or separately fabricated and attached, is a further involvement, so to speak, and gets a little deeper into some of the philosophy of construction, but I gave you the broad definition in the concept of printed circuit without trying to determine whether it is deposited component of a separately fabricated component.

Q Just so that we may be sure of our terms as we go forward, my understanding from the testimony, and correct me if I'm wrong, is that you consider a printed circuit to be a connecting harness with the component attached, either in situ or –

A Right, and, as I have tried to somewhat apologize for my inability to recall the standard definition, I

think it is, in essence, what the standard definition is, the military standard definition. There is one.

Q What is your definition, again to keep the terminology clear, or simply a printed circuit board, which would be, as I understand, the connecting network or harness you talk about.

A That is it, what you said, it is just an interconnecting harness, a harness on some supporting board that would be a printed circuit board, without trying to define how that harness is made, again it is a broad term. And, as you well know, the term printed circuit, unfortunately, is a misnomer, it has been abused considerably by popular usage, and it has become associated with the Centralab type of circuit which we discussed a moment ago, as well as what we today call a printed wiring type of thing, it is still called a printed circuit in popular parlance, and that is why I say I used the term very generally, printed circuit is a broad embracing type of phrase to me, identifying either one type of component or another.

Q Do you distinguish, then, between the board or hookup and a component?

A No, they are both components.

Q They are both components?

A Yes.

And in our own activity we call it a printed wiring

board or a printed circuit board, I think the more general term perhaps is printed circuit board, as an electronic component, much in the way that we look at hookup wiring with its installation as a component.

In this particular case I would say that the printed circuit board once again is another form of hookup wiring with attendant accessories to make it functional.

Q Do you draw any distinction in your appellation of a printed circuit board as a component based upon the pattern on the board?

A No.

Q Now, Mr. Danko, would you go to the point, and go to the date of that point at which you became associated with Mr. Abramson's group. Tell us what your duties and responsibilities were there.

A I became associated with Mr. Abramson's group, really it was Mr. Rodgers' section, the component parts section, in June of 1948.

Once again I have – you made mention earlier when I got up here that I had a briefcase, and, for two reasons, one of them is that I have a chronology, a chronology of dates, and the only reason I have this is that the files relating to the period from 1946, when printed circuit activity began in the Signal Corps, to about 1951, consists of perhaps 1000 pieces of correspondence, and it would be

extremely difficult for me, for the sake of clarity, to keep dates in proper order, and so I did, for the purpose of my – for my own benefit, I figured a chronology, which merely gave the correct date, rather that say on or about, I could say specifically.

Q I have no objection, in fact, I would prefer that you do refer to the chronology.

Mr. Blenko, do you have any objection?

THE COURT: This is prepared by you?

THE WITNESS: Yes.

MR. BLENKO: No objection.

A This is about June of 1948 I joined Mr. Abramson and Mr. Bowen's section.

Q Just so that our subsequent reference to correspondence will be meaningful, would you explain the somewhat circuitous handling of correspondence in the Corps. I note that Mr. Bowen seems to sign a great preponderance of the letters that we have had. Is this the usual practice, does the section chief sign the letters?

A At that time it was, the section chief was responsible for everything that went on in that section, it didn't matter who prepared it, he was responsible, and it was the practice at that time to have all correspondence signed by Mr. Bowen. The preparing engineer would put his initials in

the upper right hand corner.

Q I was about to ask you that question, Mr. Danko.

Can you, by looking at these various documents, tell us who wrote them, usually?

A The originals that went out, I could not, but on the carbons, which I retained, and other carbons which ended up in our mailing records, always had preparing engineer's initials, the typists initials and anybody else's initials who was in the tortuous path of outgoing mail.

Q Mr. Danko, you mentioned that while you were in the group where you evaluated a few printed circuit type materials, you received the reports which were of

interest in the printed circuit field. Does that, sir, include the reports sent to the signal corps by the Kenyon Instrument Company?

A Yes.

Q Do you recall on or about what date you first saw the Kenyon reports?

A The distribution was automatic. I would say I had the first Kenyon report sometime in the fall of 1947.

Q I will hand you a group of reports from the Kenyon Instrument Company, to the Signal Corps, beginning with a first quarterly report on 15 September, 1947, and then continuing through a total of seven reports, terminating in a final engineering report on the development of printed electronic circuits, under date of March 15, 1949. This

series of reports already has been introduced as Defendant's Exhibit 410.

Would you please look at those reports and tell me if they are the Kenyon Instrument Company contract reports to which you have referred?

A Yes.

Actually I didn't receive all of these reports during that period, because some of these are March, 1949, at which time I was located not in the Abramson section.

Q Let's look particularly at the first two reports, Mr. Danko, and get their dates in the record. 15 September, 1947, and 15 December, 1947. Do you have a recollection of having perused or studied those reports prior to your move to Mr. Abramson's section?

A The first one I know I saw. The second one I am not sure.

In other words, in that period of time that we are talking, I am not sure I saw the second report.

Q Had you seen in subsequently?

A Oh, yes.

Q Did you see it recently for the first time, or had you seen it, let's say, before January of 1949?

A I have seen it many times before.

As a matter of fact, maybe to clarify this, when I joined Mr. Abramson in June, 1948, I was given a complete

orientation, I may call it that, by Mr. Abramson as to what had transpired.

I was given contract control – excuse me, not contract control. I was given all of the records pertaining to the contract. They are now under my control. In other words, I was at the project engineer.

So at that the first, second, third, and et cetera reports all came under my purview and were stored by me in my contact file.

Q Would you generally define for us the subject matter of the Kenyon contract; what was accomplished?

A Again, what period of time do you want? Do you want me to look back on the whole Kenyon contract after March, 1949?

Q I would like you to consider the whole Kenyon contract as reflected by the reports you have in your hand, beginning in 1947, in September, and tell us what the subject matter was, and what was accomplished.

A This was essentially a study type contract.

We distinguished between study, sometimes called research type contracts and development contracts.

There are two broad classifications in a research contract, such as we gave Kenyon.

We essentially turned their researchers loose on a field. We gave them an open field to explore, and to see if

they can consolidate some technological phenomena possibly into useful or potentially useful purpose.

This is to distinguish from a development contract, where the man has been specifically instructed to develop a device, and it must meet certain requirements and so on.

What I am driving at, is that Kenyon had a certain license to explore the field, and tried to draw together some technology, perhaps, that would possibly from the basis for a system of electronic construction that the Signal Corps was seeking.

To answer your question, however, as to what the general substance of the Kenyon work was -- perhaps I am anticipating. I don't know whether it was in the frame of your question. Should I tell what they did or what the accomplishment was?

Q I would like, in your words, without priming from me, precisely what the Kenyon contract involved, and what contribution, if any, it made to your work on printed circuitry.

A On the aspect of contribution, in the period before I joined Mr. Abramson, and this is from the written records now, as a result of my first visit with Mr. Tuttle of the Kenyon Instrument Company, I did know then, in July, 1949, that they had explored etching technique of forming metallized harness, for the general purpose of using printed circuitry

in electronic equipment.

Q What was your understanding at that time of the progress which had been made by Mr. Tuttle, and problems that he may have encountered?

A Well, his problems seemed to be considerable.

The prime problem seemed to have been the question of a bond, between a metal deposited by several means, and an insulating base itself.

He had gone to considerable pains to explore a number of approaches. His contacts with industry were prolific.

This, and, however, the results I think I would generalize as being somewhat disappointing, as of the time that I took over the project.

I would want to say that I think Mr. Tuttle was a little disappointed, too, that he had not com up with a break-through, as we generally call it, and that his considerable effort had not yielded anything of substance, that could quite satisfy the requirements of the Signal Corps.

Q In saying that what Mr. Tuttle had come up with didn't satisfy the requirements, are you talking in terms of general process, or in terms of end product?

A No, end product.

The process, I would like to say, to us was merely a means to an end.

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The thing we were interested in ultimately was the component itself, namely the harness, in this particular instance.

You must remember that we have an equipment element in this laboratory. After all, its prime function is to research and develop new equipment for the Army.

I always like to think that we, in the component's activity, were a slot, so to speak, through which we would screen those components which were to be used by these equipment people, and we would screen those processes -- I should say assembly techniques, which they might be temped to use.

So that we were, in essence, guarding the standards, you might say, of electronic equipment construction in research and development.

So that when we asked Kenyon, in our requirements, that material or process he develops shall be compatible with the military usage, we specifically had in mind such things as high temperature, shock, vibration and moisture. I guess I will stop there.

Q What was your understanding of the etched technique which Mr. Tuttle, of Kenyon Instrument Company suggested?

A What was my understanding?

Q What was your understanding of the etching process that he suggested?

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A In its simplest terms, it would be deposition of a metallic surface on an insulating base by any means, subsequently by photographic techniques, depositing a resist on that metallic surface, and subsequently resorting to some subtractive method, either abrasion – I should say mechanical paths or etching.

This is the essence of what had preceded my assignment to Mr. Abramson, which, however, I did review in total with Mr. Tuttle, when I first visited him on my orientation visit, so to speak, when we discussed background and when it happened.

Of course, what was most interesting to me is what is the next step, because I was now directly involved in this next step.

Q Considering the general process which you have just recited, and overlooking the bond problem, do you find any basic difference between that process as suggested at that time and the photoetched technique that you now know of?

A Speaking generally I would say not.

The principle was there. I mean, the heart of the concept was there.

Of course, the technologies, the processes, the materials have changed considerably.

As a matter of fact, if I may venture an opinion at this point, without being asked, it was a difference between

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success and failure.

There was a reason for his failure up to that time, to produce what you might call an acceptable harness, primarily because he could not get a good bond.

The thought was there. He could not reduce it to practice, perhaps you might say to useful practice, at least to the satisfaction of the Signal Corps, we will put it that way.

Q Will you tell us what occurred in the Kenyon development after you became responsible?

A The contract was about a year old, and as I recall this was an 18 month contract. It was to close in November, 1949. Somehow the dates don't jibe. Let me just check.

Q Please refer to the reports there.

A No, the contract was to terminated in about six months or so, in November, 1948.

The technical effort was supposed to terminate in November, and we only had six months in which to show something for the money that was being expended, and the considerable effort on the part of Mr. Tuttle.

In view of his disappointing results, I might say that I instructed Mr. Kenyon to fix on what he thought was the best technique, that he had worked on to that date, and the date that I spoke to him might have been in July or August, 1948, and to actually begin the fabrication of 20 samples

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called for under contract.

I didn't have anything to do with the making of the contract, writing up the original requirements which called for 20 samples.

I possibly, in retrospect now may not have required a man who is doing research work to submit samples of working circuits. It is a little presumptive to turn a man loose in a virgin field, so to speak, and to have him come up with a concrete system. But we have hoped to do this with Kenyon[2], and since by the time I took over, there was not sufficient time left to further research into the technologies, I felt it was time that we turned our attention to supplying samples, the models that were called for, 20 in number.

The reason for my concern was this: A contract is an obligation, which Kenyon had to meet. If he didn't want to deliver those samples, he would have to take a cut in the contract price.

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[2] NLB 2862 - Kenyon Reports 9-15-1947 1st of Seven. KENYON INSTRUMENT COMPANY

He had been diligent, he had been active, and generally speaking from the research point of view, he had done a fairly thorough job or exploring the arts within his sphere of knowledge.

I think it would have hurt him to have to relinquish a substantial sum for non-delivery of these 20 samples.

In discussion with him we did agree that one of the photographic techniques -- he had a name for it called

Gelati silver halide.

He was most enthused about that particular process. This had nothing to do with etching. This was one of the other tangents that he had explored.

But it seemed that he was able to form a conductive image using that technique, and we agreed that we would use that process of harness making to actually put together this assembly, and this we proceeded to do, during the remainder portion of the contract, while he continued to, on a more limited fashion, explore the technologies.

Q I will invite your attention, Mr. Danko, to page 5 of the final Kenyon report of March 15, 1949, and particularly to that portion near the bottom of the page which reads as follows: "Acid resist stencil image.

"Many photographic emulsions can be made to serve as acid resists, but only to certain of the oxidizing acids such as HNO3. Had it been possible to discover during the part of the program devoted to metalizing insulators a means of getting a satisfactory bond between plastic and such a metal as silver or copper, the acid etching technique might have proved useful in the project."

Do you find that the statement to be an accurate statement and to reflect the opinion that you have given with regard to the Kenyon effort?

MR. BLENKO: If the Court please, I object to the

question. I don't know whether the witness is being asked to state his own knowledge, or simply to state that that is what was in the report and what Mr. Tuttle had told him.

THE COURT: I thought he was being asked to state whether or not he had concurred in that statement.

MR. BIRCH: That was my intention, Your Honor.

MR. BLENKO: But is that a concurrence on the basis of experience and his own independent review of all of these methods, or is it simply a concurrence that that is what Mr. Tuttle told him or reported?

THE COURT: No. You don't concur in what somebody told you. You may agree that that is what they told you. You concur in the result expressed, you don't concur in the result expressed.

The question, as I understand it, is whether or not Mr. Danko agrees with the statements made, regardless of the source of the statements, and is that a correct summary of the state of the art as he believed it to be as of that time.

MR.BLENKO: As he believed it to be or knew it to be, is my question.

THE COURT: Mr. Blenko, I may regard as knowledge that which you consider to be only my belief.

I don't know how you can say a person knows a thing to be true. All he can say is that based upon the information he has, he has a completely satisfactory conviction that it

is true, but that doesn't make it true.

Therefore his purported knowledge of the truth does not make it true.

All I think anybody can say is that this was their affirmative belief or conviction or opinion as of a particular time.

MR.BLENKO: Very well.

What report are you referring to?

MR.BIRCH: This is the last one, Mr. Blenko.

MR. BLENKO: What page?

THE COURT: It is a question of semantics and logistics, perhaps, Mr. Blenko, but if your field was religion, I would have less difficulty.

BY MR. BIRCH:

Q Mr. Danko, in view of the colloquy you have just heard, I will ask you is the statement we have read into the record an accurate description of the Kenyon effort as you understood it with respect to the foil etched technique?

A I concur with that statement.

MR. BLENKO: What page were you on again?

MR. BIRCH: Page 5.

MR. BLENKO: Page 5? Thank you.

BY MR. BIRCH:

Q Mr. Danko, following your experiences with Kenyon, what was the next step in the Signal Corps development of

printed circuitry, or if there was a development which was concurrent with the Kenyon effort, please tell us what that one was.

A Well, it was a neophyte, so to speak --

THE COURT: Let me interrupt. I didn't mean to interject myself extensively there, but I think we ought to have an understanding on it.

What was influencing me, I believe, Mr. Blenko, was this: When I write an opinion, I think I know what the law is. After it has been reviewed, I sometimes find out I did not. So that all I can express is my opinion of what the law is, not that it is in fact the law. That is in substance what I had in mind.

MR. BLENKO: Yes.

THE COURT: I may still be convinced that I knew what the law was, but for practical purposes, I am told I don't.

BY MR. BIRCH:

Q Do you recall the question, Mr. Danko, or would you like it read?

A Well, essentially what was the next step?

Q That is correct, sir.

A Being newly assigned to the project, I felt that there is a need for a sampling of opinions of other people in the country, specifically in the electronic industry.

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I didn't feel that I wanted to live in an ivory tower confined to Fort Monmouth, so to speak, with regard to what was going on in the world.

So one of the first things I suggested is that the Signal Corps approach a number of leading electronic people and to get their viewpoints on this whole activity.

A decision had to be made over here, actually, with regard to the long range projection of the Signal Corps, as to whether we were going to take this whole subject of printed circuitry up as a serious research and development effort, or whether this first exploratory search that we made with Kenyon, which was disappointing, generally speaking, could essentially be the death knell of our activities.

At the time truly we already had solicitations out for lab development of printed circuit assemblies. These were to ultimately become the Balco and Herlec contracts.

The contractual operation was already in effect, when I arrived in June, 1948, so I didn't have any control over those.

But I did feel that we had to have more substance and more opinions and more knowledge of what was going on in the printed circuit field other that what we were able to read, and we were able to get from Kenyon.

So I did suggest to Mr. Abramson that we conduct a survey, and we planned that survey accordingly in July.

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We picked the mid west, because of the concentration of electronic industries there, and we did in fact perform such a tour in the period, 27 July to 4 August. That was within two months or so of the time that I took over the project.

This was an effort to learn a little bit more of what was going on in the outside world by first hand knowledge, rather than by reading through literature.

Q On whom did you call, Mr. Danko, if you remember?

A Well, I will have to remember now.

Zenith, Motorola, Beck's, Minneapolis-Honeywell, Minnesota Mining, Belmont Radio, and it seems there are one or two more that I can't recall at the moment.

THE COURT: Any RCA or RCA affiliate?

THE WITNESS: No, this was the mid west only.

BY MR. BIRCH:

Q You later contacted RCA, did you not?

A Yes, much later.

Q We will get to that a little later.

Can you tell me, as we go down this list, what you found to be the stat of the art of printed circuitry at each of the organizations upon which you called, and first let us consider Zenith.

A Well, again, I am falling back on memory.

If I hesitate, please forgive me.

Zenith was interested in a remote sort of fashion.

As I recall, they did not have any printed circuit activity as such in the house. They were, as they put it, watchful and assessing the art as a development, but they were, themselves, not participating.

Q Motorola, what did you find the activity to be at Motorola?

A I would say it was essentially the same. They were another one of the watchful waiters.

They themselves, as I recall, at that particular time, did not indicate to me that they were carrying on any printed circuit activities.

If I refer to some document I might be a little bit more precise.

Q Surely.

THE COURT: Yes.

A I am afraid I do not have that document.

Perhaps you might proceed.

Q Were you then not made aware of any research activity of Zenith at that time in the printed circuit field?

A I was not made aware of any activity at Zenith.

Q I am sorry, Motorola.

A Or at Motorola, as I recall.

Q Did you subsequently become aware of printed circuit development by Motorola?

A Yes, the Pla-Cir process subsequently was announced. When I say subsequently, that was several years later, and it was announced by Motorola.

Q And you have no idea what the date of inception of their research was?

A No, sir.

Q Or what level it might have been at at the time you were there in 1948?

A No.

THE COURT: At the time that you were making this survey, did you have any feeling or impression as to whether or not you were being given full, complete and frank disclosure, or whether there was any holding back?

THE WITNESS: Generally speaking I would think that we did have open sesame, so to speak, with various people we contacted. They were frank and we were frank.

We told them this had to do with a decision that had to be made by the Signal Corps, as to whether to pursue this particular art, and I do feel that in almost every case we did get an open expression of interest, and what was going on in the house.

The thing that we did find considerable reluctance on on the part of some of the people that we contacted was to divulge process details, the propriety techniques or materials or approaches.

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They would, in those cases, merely generalize. On the other hand, others allowed us to see almost everything.

Incidentally, one other activity I did forget to mention, and I don't know how I could possibly forget, was Centralab. We included Centralab in our tour.

Q How did Tele-Tech[3], Mr. Danko, did you visit them?

A I think we did at that time.

Q I ask the question because I happen to know they were in the mid west at the time.

A I think at that time we did, but if not at that time, shortly thereafter we did contact Tele-Tech.

Q I ask the question because I happen to know they were in the mid west at the time.

A I think at that time we did, but if not at that time, shortly thereafter we did contact Tele-Tech.

Q The next one you have mentioned is Becks. Can you tell us, as fully as possible, your relationship with Becks?

A Becks was not one of the big names obviously in the electronics industry.

He had been contacted by the Signal Corps via a letter, several months before, indicating to us that he had something in the way of printed circuits, and in a subsequent reply we indicated that inasmuch as we were going to be in that area, that we would like to contact him personally, and discuss this material that he wanted to show us.

Q I will hand you a compilation of documents which has been marked in evidence as Defendant's Exhibit 423, and ask you if you can recognize the first letter appearing in that file, under date of July 8th, I believe it is, or 6th.

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It is July 8th, 1948, to the Commanding Officer of the Signal Corps, unsigned on this copy.

A This was received from back at the Signal Corps. I recall it. It was signed. This apparently is a carbon copy, possibly.

Q Yes, that came from Mr. Beck's file.

Please continue.

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[3] Telex

A We did contact Mr. Beck on the 2nd and 3rd of August, two days, apparently, at which time he showed us end products of the process which he identified as the Beck process, and from then on I think that is the way we referred to it.

Mr. Beck was one of those whom we had contacted who was reluctant to give us any details as to how he made his products.

However, he did tell us that he was associated in the past and had been associated with the Buckbee Mears people, a photoengraving organization. He showed us some of the products of the Buckbee Mears, and took us on a tour of the plant of Buckbee Mears.

In many ways he let us know that it was the facilities of the Buckbee Mears, and the talents of Buckbee Mears that were behind his process, without telling us what it was.

We saw etching tanks, at Buckbee Mears. They were making reticules at that time, and we saw some of the very fine

work that was being done by the photoengraving process.

As a matter of fact, it was my first experience with a commercial photoengraving organization, where I could see the large volume type of operation that was going on.

Mr. Beck showed us a number of circuits that he had made, apparently just samples of various types, and expressed a desire to find a useful end for his product, presumably of primarily the military. He felt that we were in the market, so to speak.

This was his point of entry, and he essentially asked us to assist his product.

Q Mr. Danko, I will show you a series of four photographs which have been marked as Defendant's Exhibits 419-A, B, C, and D, and ask you if you recognize anything you see in any of those photographs?

A This 419-A is just an office space.

Q Do you recognize any of the people?

A Well, this gentleman over here, on the upper right, or this gentlemen next to him, is John Beck, I would think. It has been a long time.

Q That is justifiably confused. It is our understanding that we have three Beck brothers here.

A I must admit they all look alike.

THE COURT: And a Beck daughter.

Q And a Beck daughter, that is correct. Mr. Beck

testified he kept everything in the family.

A I would say on 419-B, the gentlemen in the upper right is Mr. Beck.

Q Do you recall having seen any of the equipment that is there in use?

A Well, the laminating press, I have a vague recollection of. There wasn't too much interest on his part, as I say, to discuss these process details. He felt they were

proprietary, but he did say that he could let us have it, after he had studied the possibilities, or however he phrased it. I don't recall right now.

But I merely say that he was reluctant to give it to us, but he said he could give it to us in due time.

We were truly not interested in the process, but merely to see whether this again was one of those one shot laboratory type of things, or whether it had mass possibilities.

After all, the Signal Corps is a substantial buyer of electronic equipment for the Army, and the thing we were looking for was something that did have possibilities for production.

Some of these techniques are rather sophisticated, and sometimes requires Fort Knox to make one sample out of it. So in essence, we were looking for something that would be easy to make, economical, reproduceable, and could be honestly speaking available from many vendors. That is the

essence of the components philosophy, is to get things from many people, of a uniform grade, at a very good price, and immediately on demand.

Q Would you please look at the remaining photographs, 419-C and D. Do you recall having seen the equipment?

A No. Frankly the only thing that retains an impression is this laminating press. These other activities, I am sorry to say, I cannot recall as such. It has been quite some time back.

Q Mr. Danko, you have testified that Mr. Beck showed you through the Buckbee Mears plant, and you had seen etching equipment. Did you see the photographic equipment?

A Yes, cameras.

Q Can you tell us when you came away from the tour on the 2nd and 3rd of August, 1948, whether or not you had any idea of how Mr. Beck was making printed circuitry that he showed you?

A Well, I had an idea, certainly. The association which he himself and Buckbee Mears, the fact that he had had a prior employee relationship with Buckbee Mears, suggested that some of the talents that he had used at Buckbee Mears were now being used in making these circuits which he showed us.

But we were confused as to how he managed to get those little feet that he had on each terminal, on each termin-

al spot, on a printed wiring harness that he showed us.

Q I show you an object that has been marked in evidence as Defendant's Exhibit 422[4], and ask you if you can identify it.

[4] NLB 2876 - #422 Circuit mailed to Mr. Beck, assembled by Lanzalotti

A It looks like the circuit that -- I have a record that we mailed this to Mr. Beck after receiving certain procured printed wiring boards from him. This was made by Mr. Lanzalotti, at Fort Monmouth Laboratory. It looks very much like it.

Q You mean the components were assembled on the board by Lanzalotti?

A Right.

Q Would you turn that board over and see if you can find the little feet?

A Yes.

Q That you have testified about?

A Yes.

Q As I understand your testimony, you were confused with respect to how those little feet got outside the board; is that correct?

A Right, and we could not rationalize the etching process and those feet.

As it subsequently developed, and as Mr. Beck[5] has now permitted us to reveal his process, in a recent letter, it was a multiple etching operation, a two etching resist, or two

resists operation, where he partially etched down the first time, and resisted the surface again, and then proceeded with a secondary etch.

But these are the panels that we subsequently did receive at the Signal Corps on a purchase order.

Q At the time that you left the Beck plant, did you have a belief with respect to how Mr. Beck was producing printed circuits?

A Yes, I would say we had a belief, but it was not supported by anything at all that Mr. Beck said. He never used the word “etching” in relation to his product. It was just by association.

Q Just we we may be more clear on the record, Mr. Danko, will you state that belief which you say you had when you left the Beck organization?

A I believed that, when I left the Beck’s plant, what he was using an etched technique in the production of the samples that he had shown us.

Q You have referred to samples by Mr. Beck and/or his organization produced for you.

I will ask you to look at a further letter in Defendant’s Exhibit No. 423[6], which is dated 14 September, 1948, and ask you if that letter refers to such samples.

A Well, -- we did follow up our contact with Beck with a request that he supply us with samples made to out prints, so to speak, and this is the letter that described what we were going to procure from him.

Q Perhaps this is a good point to illuminate us all with respect to the way the correspondence is handled.

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[5] NLB 2876 – Multiple etching process by Beck

[6] NLB 2878 – 9-14-1948

I see some initials up in the top right hand corner of the letter of September 14, 1948.

Can you tell us who wrote the letter from those initials?

A Well, S.D. are my initials. M.A. is Moe Abramson, and B.V.M. is Barbara McNeery, a stenographer.

Q I note here a document which says "request for proposal and contractor's proposal," W.D. Form 104 on the bottom.

Does this document refer to the same samples?

A Yes.

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Q Were those samples ultimately received?

A Yes.

Q I will hand you an object, Mr. Danko, that has been marked in evidence as Defendant's Exhibit No. 420, and ask you if you have any familiarity with that or of a similar object.

A Well, these are similar to the samples that we received and it is a copper circuit on glass.

If I may volunteer here, and I don't know whether this is proper or not, that these samples, when they were received at the Signal Corps, of course, were Government property, inasmuch as we paid forthem, and throughout the years we had kept these samples on hand.

And prior to this hearing, I had gone to our ancient files, as we call it, and had resurrected these samples, and I had laid them out in an orderly fashion to help clarify the situation, if there is any need for clarification, with regard to what we received at the Signal Corps on the Beck purchase.

I have such samples on hand, if that is proper. And, as I say, I am volunteering some information here.

Q I think we would be interested in seeing the samples in detail. Would there be onjection to having them marked into evidence if they can be returned at a later date?

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A I have no objection. They have served their purpose so far as we are concerned, they are historical specimens, and they are useless to us in that sense, but I would like to have them returned.

Q All right.

Will you produce those samples?

First, however, I would like you to look at another document here with respect to the exhibit you have just identified. I have letter here of 14 September, 1948, which we have just looked at.

A Yes.

Q And appended thereto is a sheet No. 1, bearing the date of 9 September, 1948, and the title Tone Control Circuit.[7]

[7] NLB 2880 – 9-9-1948 Tone Control Circuit enlarged draftsmen's drawing

I will ask you if there is any similarity between the tone control circuit on the sheet and the sample you have in your hand?

A They are identical, it is an enlarged draftsman's drawing.

Q Would you please produce the samples if you have them?

A (Witness complies)

MR. BIRCH: Mr. Blenko, would you like to come and look at these samples.

Q Now, can you run through these, Mr. Danko? As I

understand, these are the samples which were obtained from Beck?

A Well, this is the residual, after all we did test some of them; undoubtedly we lost some of them, but this is what is still in our files, so to speak, and they are identified by the same numbers that are on the purchase order, item 1, item 2, item 3, item 4, item 5.

Q All right, let me get the purchase sheet

Would you hold this please (indicating)?

As I understand your testimony, Item 1 is – would you read that from the purchase order please?

A "Pattern metal No. 1, copper prepared by Beck process on unglazed steatite."

Q Are those the samples which show under Item 1?

A Yes. There are three specimens.

Q Would you please read --

A "Pattern metal No. 1 copper prepared by Beck process on glass."

Four samples on the purchase order, and we do have five samples on the card, one of which is identified as an extra samples volunteered by Mr. Beck along with the

order.

Q I will ask you to compare Item 2 in the folder, which we are examining, which contains the samples you have produced, with Defendant's Exhibit No. 420.

A The patterns are identical.

Q Would you please read Item 3?

A "Item 3, pattern metal No. 1 copper prepared by Beck process on phenolic."

Q I note that the surface of Item 3 is essentially flush, is that the fact?

A Well, Mr. Beck, in submitting these items, did indicate – did identify every sample by its peculiar construction.

Now, he used variations in the Figure 4 item, three samples submitted, and we have so identified them on there, and the identification, for example, the first sample is identified as bonded with B-adhesive and sealed with same. Those are my words, type A.

Now, Mr. Beck identified, in the letter which is in our records, with the characteristics of each one of those, what he sealed with it, what he surfaced it with, and also what the base material was. There is such a letter in the file.

Q Would you look at that compilation, Mr. Danko, and see if you can find such a letter?

A (Witness examines exhibit)
No.

Q I invite your attention to Defendant's Exhibit No. 423[8], which is a compilation of correspondence between Beck and the Signal Corps, and particular to – let me if there is a date on this – particularly the latter of January 18th, 1949, and to an accompanying sheet, and ask you if that is the descriptive sheet you referred to identifying these samples.

A That is right.

Q Would you go back to your purchase order and refer to Item 4?

A Item 4, pattern metal No. 1, copper prepared by Beck process on methyl-methacrylate," and that is the item – these four samples we have on the sheet here (indicating).

Q You mean in the folder that you have supplied containing the samples?

A Yes.

Q Would you read Item 5?

A "Item 5, pattern metal No. 2, copper prepared by Beck process on phenolic."

Q I note that we have a fixed group in the folder, Mr. Danko, which is entitled "Other Samples (Letter from Beck to Signal Corps 18 January 1949, no charge)": where did this sample come from?

A This came with the letter of 18 July from Mr. Beck, volunteered by him as above and beyond the order, and they were not tallied in on the order; they were essentially what you might call gratis samples.

MR. BIRCH: I offer in evidence the folder of samples which has been identified by the witness.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 459.

(Thereupon, a folder containing samples of Beck process marked Defendant's Exhibit No. 459.)

BY MR. BIRCH:

Q My attention has been called to the fact that you said 18 July, Mr. Danko, is that the date that these actually were received?

A No, 18 January, 1949.

THE COURT: Item 5 refers to copper on both sides.

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[8] NLB 2883 – P.O. and I.D. the same 1 thru 5 #423 1-18-1949

BY MR. BIRCH:

Q Mr. Danko, you have identified a purchase order. I will hand you a group of documents which received from the Signal Corps under certification, and which contains six different items.

The date of the receipt of the certified documents being 24 October, 1961, and I will ask you if the first item in that compilation is the purchase order that you have pre-

viously looked at?

A Yes.

Q Would you look at the next item in the file and identify that if you can?

A This is an incoming tally, which records a shipment coming in, checked against the contract itself.

Q And does that incoming tally establish the receipt of the samples?

A It establishes the receipt of the 16 samples.

Q Now, proceeding through that compilation of documents –

A I am sorry, 20 samples, five times four.

Q Would you please identify, if you can, the remainder of that?

A The next item over here is Component Material Branch Information Bulletin 102, written about seven months after the receipt of the Beck samples.

Q The next item?

A (Indicating)

Q Yes.

Please identify the hand written memorandum in that compilation.

A It certainly is my handwriting, dated -- called the Beck Signal Corps activity, dated July, 1953.

Q Can you tell us why that handwritten memorandum

was written?

A As I recall, this was on -- was related to our – a patent application that had been made by the Signal Corps for a process called Auto-Sembly. And it was essential, apparently, to clear up certain points with regard to the origin of the concept and historical background, and I think that this document, handwritten, was prepared by me for our patent activity in the clarification of certain points which they had asked me to elaborate.

Q Have you read the memorandum recently?

A No.

Q Would you please look at it, particularly the first page or two, and tell us whether or not the statements there made accurately reflect the relationship you have just testified about with Beck's?

THE COURT: We will take a short recess.

(Short recess taken.)

THE COURT: Good afternoon.

Mr. Birch.

BY MR. BIRCH:

Q Mr. Danko, before the recess, I had invited your attention to the handwritten memorandum of July of 1953, and asked you to read it and tell us if you could why it was written.

THE COURT: He said it was in connection, he thought, with a patent application relating to the Auto-Sembly.

Q All right.

He has now read the entire article.

A I have.

Q Do you have anything to add?

A No.

Q I asked you specifically to review the article and see whether it accurately stated the facts with respect to the Signal Corps' relationship with Beck's.

A I believe it does.

Q Now, would you go to the final document in this compilation under date of 1 July, 1948, which is entitled "Information Bulletin No. 68": can you identify it?

A Yes.

This was prepared by Mr. Abramson and myself as one of the first documents when I took over the project engineer's status in printed circuitry.

Q Now, noting the date of 1 July, 1948, how would you place that report as compared to the activity with Kenyon and Beck's?

In other words, how much of Kenyon had gone by at that time?

A Well, as I said before, I had been on this activity, now at that time this was written and issued, not more that a month or so, and this is essentially a summary or a reference point from which I would take the next action, so to speak.

This is looking back over what had transpired, and essentially summarizing the situation as Mr. Abramson and I saw it as of 1 July, 1948.

Q Do you know what distribution was given to Information Bulletin No. 68?

A In general Information Bulletins were an "In House" organ.

However, where there were people outside of the laboratory who had interest in this activity, we did, either sometimes on request or voluntarily, offer these information bulletins on a professional exchange basis. So, primarily, this is limited as an in-house document here, and at that time we were occasionally distributing them outside.

Q I notice on the chart, which forms a part of Bulletin 68, there is a compilation of the printed circuit processes, and I note, under Item B, there is a little sub-

script “Two” in the center column, and that same “two” appears under Item D, and I note on the final page of the tabulation it says “Two experimental” in the footnote.

Did you, in that compilation, include the Kenyon work?

A It was intended to reflect some of the Kenyon work.

Q Can you tell us which of these particular items reflected the Kenyon work?

A In the tabulation, I would say Item 1-C which refers to photograph resist, and the words “differential acid etching.”

Q I note in the second column the words “vacuum evaporation, metallic conductors, metallic resistors, protected by photoresist during acid etching,” is that your characterization of the Kenyon process as disclosed to you?

A Yes.

Q And the “two” means that it is experimental?

A Right.

MR. BIRCH: I offer in evidence the compilation of documents certified by the Signal Corps, which have been identified by the witness.

MR. BLENKO: No objection.

THE CLERK: Defendant’s Exhibit No. 460.

(Thereupon, compilation of documents certified by Signal Corps marked

Defendant’s Exhibit No. 460.)

BY MR. BIRCH:

Q Mr. Danko, I would like again to invite your attention to Defendant’s Exhibit No. 423, which is a compilation of correspondence passing between the Signal Corps and Beck, and, in particular, I would like you to look at the letter of 28 February, 1949, and the little clipping which is stapled to the back of that letter, and ask you if you can identify it?

A Yes. This is a portion of a report on the results of our survey trip through the Mid-west in July and August of 1948.

We had clipped out that portion that related to Mr. Beck’s operations to let him know what our summary view was of his process.

Now, the reason for clipping it out is that we did not want him to know what we had said about other organizations, which, of course, was in a continuous report; we only cut out that portion which was of interest to him.

Q Where in this cut out that you identify did you start describing the Beck process?

A Well, only insofar as an end product is concerned.

As I said before, Mr. Beck would not divulge the process steps. So, we merely comment here on the general characteristics of the end product, namely that he had in-

vented a method of depositing a metal on any base material in thicknesses up to 20 mils.

Q Would you read the rest of that into the record, please?

A "The exact nature of the process was not disclosed but details were promised through formal channels. The process exemplified by submitted samples appears to have definite advantages. The comparatively thick metal layer is an excellent conductor. The possibility of using any base material (from thin plyable plastic sheets to ceramic) is very desirable. Designs can be plated on both sides of a base and ribbon or eyelet connections made through the material. The production cost is assertedly low, and the process is very flexible in that a circuit change can be made very readily without expensive changes in molds, dies, et cetera. Soldering to the metal pattern is easily done, the tinning being effected electrolytically. The Signal Corps proposes to investigate the process further by requesting specific patterns be laid on various types of materials. These will be checked for ruggedness, shock resistance, conductivity, adherence, et cetera. It is to be noted that Beck's process is confined to the conductive pattern only and does not include any components as such."

Q Now, as I understand your testimony, those samples which you there reflect the intention of the Bureau to order,

are the samples which you did order and receive, which are exemplified by Defendant's Exhibit No, 459, is that correct?

A That is right.

Q Did you continue in your relationship with Beck's after the receipt of those samples?

A Yes, for some time there was an exchange of correspondence.

I recall perhaps one or two more personal contacts with Mr. Beck.

Q Did you find that the Beck process continued to be satisfactory?

A Well, we had run some solder dip tests consistent with the concept which we had arbitrarily called Auto-Sembly, and the Beck patterns satisfactorily withstood the solder dip test. On the basis of solder dipping alone, the Beck samples were excellent, particularly those samples with claw feet.

Some of the survey samples that did not have claw feet also were satisfactory.

I would say then that the Beck samples from a strictly functional point of view met the criteria for Auto-Sembly harness.

Q By feet, you mean the little tabs on the bottom of Defendant's Exhibit 422?

A Yes. They were particularly good, and it seemed

that they helped maintain the bond between the pattern and the insulating base during the solder dip operation.

Q I will invite your intention to a letter of 3 May 1949 appearing in a further compilation of correspondence furnished by the Signal Corps, and certified as authentic, and to this statement in the fourth paragraph:

"In view of the progressively better results being realized with your pattern technique, this Branch intends to recognize the Beck process as one of the acceptable metallization techniques, and will recommend its use in applicable laboratory designs."

Can you identify that letter?

A Yes. I prepared that letter, and it is in our files also.

Q Does the statement I have read accurately reflect your opinion of the Beck devices?

A Yes.

Q Would you please examine the certified compilation and tell me whether you have had opportunity to examine a similar compilation?

A Well, I got a duplicate of these photostats.

Q As they were furnished?

A Yes.

Q Can you identify all of that correspondence as coming from the files of the Signal Corps?

A Yes. I haven't identified these one by one, but I assume that since this is a ribbon (indicating) that these are all proper and they did come from the files.

In other words, I furnished the originals to Mr. Prouty, who subsequently, I think, saw to it that those were duplicated.

Q For the record, who is Mr. Prouty?

A He is our patent advisor at the Fort Monmouth Laboratory.

MR. BIRCH: In order that we may refer to this by exhibit No. I will offer this compilation, as identified by the witness and certified by the Army in evidence.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 461.

(Thereupon, a compilation of certified documents by the Signal Corps was marked Defendant's Exhibit No.461.)

BY MR. BIRCH:

Q Now, you have stated, Mr. Danko, that there came a time when Mr. Beck disclosed to you the exact details of the processes employed by him to make the samples you have identified.

Do you recall when that occurred?

A Yes, and it is a matter of record, and I have the date 24 February, 1949.

Q Is that the date of the receipt of the disclosure according to your records?

A Frankly, I don't know whether this -- includes the little lost time between the time that the Mail and Records Section gets it and I get it, which generally is a day or two days or three days, sometimes, but I assume if I followed the pattern when when I made up the chronology, that this is the date of the letter, or close to it.

Q I will hand you a further compilation of certified documents, which has been marked as Defendant's Exhibit No. 421, and ask you if that is the disclosure you received, inter alia?

A Yes, this is it, and it is dated February 22nd, and my date 24th apparently came from the Signal Corps stamp which ordinarily would be on the back of it -- and it is (indicating) February 24th, the date of receipt at the Signal Corps Engineering Laboratory.

Q Mr. Danko, we were proceeding with the group of organizations interviewed by you on your tour.

Let me first as you was Bulletin 75 ever released in toto? Bulletin 75 being the trip report?

A No, I think we were -- we restricted that circulation in as much as it involved comments on organizational attitudes and processes and perhaps some in-house work. We did not include any process details in that survey report, but its

distribution was very limited, it was strictly an in-house distribution; if any did get outside, I am sure it was inadvertent, other than what we ourselves sent out, namely to Beck; we did cut out the excerpt and mail it to him.

6-1 Q Now, the next organization you have listed as being visited in the period between July 27th and August 4th, 1958, was Minneapolis-Honeywell. What did you discover at Minneapolis- Honeywell with respect to the state of their progress in the art of printed circuits?

A Minneapolis-Honeywell had a technique unique of those that we had discussed up to now.

They were stamping out a grid or harness to retain the terminology I have adopted, out of a solid sheet of material.

This harness was fairly rigid, after it was stamped out on a solid sheet, and this harness was then dropped over electronic components, physically situated in such a way as to make connections with this harness, and then soldering, or machine screw attachment was resorted to.

In the final operation, as I recall, they snipped out portions of this harness, which were not necessary to perform the electronic function, but had been included to provide rigidity and integrity, I think you might call it, of the harness.

Originally you could hold the harness up, after they got through laying it down, and attaching the components, and snipping off the parts, and these became isolated interconnecting conductors.

Q Next you went to Minnesota Mining. What did you do

there?

A Minnesota Mining was making a tape, which could be used as a stencil for spray deposition of metal on insulating surfaces.

They themselves did not have any activities in printed circuitry, but they refer us to an organization, as I recall, called Spray Wire. This organization used a gun, which vaporized metal wire and sprayed it on to any surface that you desired, through this Minnesota Mining stencil, and we had such a demonstration for us while we were in that area. It was part of the Minnesota Mining contact.

Q The next organization is the Belmont Radio. What did you find at Belmont?

A Belmont I would categorize as one of those watchful waiters.

They told us that they did not have any activity going on in the house. I don't recall much that related to our purpose.

In all of these, even though sometimes you did get a negative response, it was meaningful to us, because it showed that another organization was not interested, or was a watchful waiter, as I call them.

So the fact that we didn't get anything from the organization was significant in itself, insofar as the purposes of the survey was concerned.

Q Was there any discussion of printing and etching techniques at the Belmont meeting?

A None.

Q Your answer was none?

A None. There was no discussion.

Q At Centralab, did you find out any more than you have previously indicated to us with respect to the general nature of their product and process?

A Centralab was very open about their techniques and their processes.

They showed us how they were depositing components in situ, such as resistors and capacitors on barium titanate basis.

They showed their mechanical production equipment, their soldering operations, and the only thing they would not tell us, and I could understand why, were the actual mixes that they were using to make their resistors.

This they considered proprietary, and we certainly understood why they would not give us those or show us how they were being mixed.

Q What, if any, information or disclosure did you receive from Telex.

A Telex was applying a printed circuit process which can be described as follows: As I recall, they deposited an air drying silver ink on a clear plastic base. They then

deposited presumably by screening techniques, a carbon composition ink, and I believe they attached capacitors by soldering into appropriate places on the printed circuit pattern.

This was part of a hearing aid. And to the extent that they were actually introducing such assemblies for market, this was the only extent to which they indicated that they were involved in printed circuitry.

I am not aware of any further research and development that was going on within the plant.

Q Accordingly, with respect to the organizations you have discussed, the only organization which led you to believe, as you put it, that printing and etching was being done in the electrical field with Beck?

A Yes. But that was again by association.

Q Mr. Danko, after your return, and I assume your preparation of your report as bulletin 75, what was the next activity at the Signal Corps with respect to printed circuitry?

A One was the obvious follow-up of the Beck procurement, which we proceeded to do.

Parallel to all that we had discussed so far, was the initiation of the Balco and Herlec contracts; as I mentioned earlier, with these two contractors, we were anxious now to use specific circuits to make printed circuit assemblies.

Once again they were given some license as to the method of operation.

The reason for selecting Herlec, aside from all of the other factors that go into selecting a contractor, was the fact that they were ceramics people. As a matter of fact, the Herlec people were derivatives personnel-wise from the Centralab organization.

Some people had broken away from the Centralab organization and formed the Herlec Corporation. So there was a background of printed circuit know-how of the Centralab type with the Herlec Corporation, and that was the inducement to proceed above and beyond what Centralab was doing, through Herlec.

The Balco people were not ceramic specialists as such. They had done some previous metalization work on coils for the Signal Corps.

They were research minded people, and very learned about various scientific disciplines, namely, there was a tremendous depth of knowledge there of a research nature, and we felt that they would be an excellent corollary to Herlec Corporation, in exploiting other techniques of printed circuitry, although the exact technique they were to use was not defined in the technical requirements.

Summing thus up another way, we turned to two other organizations now to further pursue the arts, even though the

survey results as such had not been completed.

As a matter of fact, the contractual operations had already been started some time ago, so I couldn't stop them anyhow, even if I wanted to.

Q Did either or both of Balco and Herlec work in the print and etch field in the production of circuitry?

A No, not at the time.

Q When did they begin such activity, to your knowledge?

A Well, it is difficult for me to establish dates, but we kept a continual liaison with them. We furnished both of them with Kenyon reports, as a part of the normal exchange between a project engineer and the contractor.

So they had access to the Kenyon reports. We had many discussions of what had transpired under the Kenyon contract, up to that date, that is, and we discussed the successes and failures and the potentialities of some of the other approaches that had been described in the literature. So both of them, as a matter of fact, initially, as I recall, were best approached as of that date. That was the ceramic approach, silvering of ceramics, and that was their initial intent.

We had no objection to it. Perhaps I should explain, because this may be confusing. If we had seen Centralab, why pick on Herlec and Balco? The Centralab operation process, I should say, was limited in its capabilities, electronically

speaking. It could handle RC type of circuitry, but it did not have the general applicability to electronics, which is characteristic of the Signal Corps.

We have coils, transformers, quartz crystals and such, which did not lend themselves to two dimensional printing, such as Centralab was pursuing.

So we were thinking that we should try to use the available components made by people who know how to make them, namely quartz crystals, by people who had been in the quartz crystal business, transformers by the people who know how to make transformers, rather that expect a man who has had no prior experience to develop the art of making a transformer in some fashion on a two dimensional basis.

Now, we had to have this versatility in components, so that we could make circuits to cover the broad spectrum of usage that we had.

Centralab did not permit us to do that, and that is why we turned to Herlec to see if there is some relief that we could get to bring into the context of printed circuitry these components conventionally made, but attached by some method to a chassis, a printed wiring chassis.

Q When did you at Fort Monmouth in the Signal Corps laboratories first print and etch a circuit yourself?

A Well, I would say that would be in 1949, it was

quite some time after.

We had, I remember, a competent contractor in Kenyon. He was pursuing the technologies. He was contacting people who knew the plastics industry, Sam Tour, Incorporated. These were consultants, and the level of people Kenyon was contacting was excellent, so that you might say, as far as technologies were concerned, we had an organization working for the Signal Corps.

As far as in the house capabilities were concerned, we were not interested in duplicating what Kenyon was doing, namely etching.

However, in 1949, subsequent to the receipt of the bonded Beck samples, and subsequent to a visit to RCA, we -- I might get a specific date. We did etch within the Signal Corps, and that date, I would say, is April, 1949.

Q Up until that point then your contacts with contractors and other people who were etching were your only contacts with the techniques?

A Right.

Q What other contacts did you have, following your return from the Midwestern tour, and your further activities with Balco and Herlec, which you haven't given us? Who was next on the list?

A We contacted, I would literally say hundreds of organizations in the next year, year and a half, in an effort

to feed into the Signal Corps to get inputs that would help us stabilize our position for the future.

Here we are dealing with a mixture of suggested approaches.

The National Bureau of Standards symposium in 1947, for example, presented, if I may use a facetious term, a whole smorgasbord of technologies, and it was a question of any potential user to try to pick a good one out of that, and generally the one that you picked had to do with your own talents for doing that particular process.

If you are a ceramicist, and you had familiarity with ceramic technologies so that in this period following our survey, we tried to get more of these inputs to help stabilize our position with one of these techniques with which we were going to select.

Q When did you next encounter printing and etching as a technique to produce a circuit?

THE COURT: You referred to the Beck Samples and visit to RCA. Does that visit to RCA have any significance other than fixing a time?

THE WITNESS: No, it had some significance to us. Certainly, as a matter of fact, it was a rather important visit. This visit to RCA occurred on 25 May, 1949.

Mr. Abramson and myself, if I may call this this, had a continuation of this tour concept of getting informa-

tion. This was one of the many other stops that we made.

THE COURT: It doesn't quite tie in, if you began your printing and etching in April, 1949.

THE WITNESS: I am sorry. I must correct that April, 1949. April comes before May, and it seems that I have pulled two boners over here, one is a simple addition, before, and now on date.

A few days after May 25th, is when we actually performed some etching within the Signal Corps. So that would be June, 1949. I am sorry.

BY MR. BIRCH:

Q Did you have any other contact with an organization working this field, and employing the printing and etching technique before you went to RCA?

A The only other contact we had was with Glass Products Company, and this was a correspondence type of exchange.

Q I will hand you a compilation of documents, which has been marked in evidence as Defendant's Exhibit 454, and you will note the first item is a letter on the letterhead of Glass Products Company, and signed by Mr. Nathan Pritikin, a letter of October 5, 1948. Is that the Glass Products Company to which you refer?

A Yes. This followed about a month or two after our survey.

Q Will you tell us briefly what you experience with Glass Products was?

A Well, as briefly as I can, after the first exchange of correspondence, we did get some samples from Mr. Pritikin.

We did subsequently visit Mr. Pritikin, but at no time did Mr. Pritikin ever identify his process to us as etching.

It was again by association and examination of his specimens, that it was obvious to us that he must be using a photographic technique, because of the fine line work that he was getting. He identified his process, one of them, as inlaid circuits.

Another one, I recall, was micro screen circuits.

The inlaid circuit technique was particularly interesting, but at no time did Mr. Pritikin identify his process, or associate it with etching in our presence.

Q Did the samples which you saw indicated to you anything with respect to how they were made, other than photographically made.

A No. We were interested in end products, and it would appear that these were being made by some photographic technique, the circuits that were mentioned in the course of our conversation. I know I retained a feeling that somehow he was using, what I would categorize as a transfer technique.

But this was nothing that he told me. It was some-

thing that I deduced from what he was saying.

But he was very tight about his processing, and most anxious to protect himself.

As I recall, he even told me that he was not interested at the time in filing for patent disclosures, because of the possibility that he may have to reveal process details.

Q Mr. Danko, I will hand you an object which previously has been identified, or a similar one, has been identified and marked as Defendant's Exhibit 451. Have you ever seen one of those before?

A I believe these are some of the samples that Mr. Pritikin showed us, or mailed to us. I don't know which it is now.

I have seen these, and I do associate them with Glass Products, or something similar to what he was making.

Q When, if ever, did you determine how Mr. Pritikin was making his samples, such as the commutator, Defendant's Exhibit 451?

A I never did.

Q You never did?

A No.

Q What other organizations did you do business with and have contact with? I am interested particularly in those organizations which disclosed to you printing and etching techniques in the production of circuitry?

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A Well, it seems we are talking in a time frame before we went to RCA. Offhand I can't think of any others in 1948.

Q I will hand you a series of documents which plaintiffs have introduced and marked as Plaintiffs' Exhibit 48, and ask you if that refreshes your recollection in any way.

A Yes, these are apparently the notes which were delivered to the Signal Corps in 1949, in a letter somewhere in the beginning of January, as an enclosure to a letter from Sprague to the Signal Corps.

Q And what, to your knowledge, was the origin of those notes?

A Well, they were prepared by a Mr. Holman, as I recall.

Perhaps it is just a matter of checking here. Yes, it is a Mr. Holman to a Colonel Adams of Sprague Electric Company, and we had to send those notes back, subsequently, in October of 1949 on Mr. Killen's request. It is somewhat difficult for me to recollect now what was in those notes. I do recall that in those notes mention was made of the British interest and etching of foils, so that as of the time we received these notes, which my chronology here indicates was about 15 January, 1949, plus or minus a few days, one day either way, depending on whether it was a weekend or not,

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we did receive notes on a Henderson & Spalding process, as I have got noted here from Mr. Killen.

Q Do you have recollection at this time without examining the notes, of whether or not those notes contained disclosure of which you were not already aware?

A Well, I will say it did disclose something I was not aware of, but I must qualify it.

It made reference to an etching of foil technique, developed by Dr. Eisler.

But it also referred to something which we had not considered. I believe it was in that letter, in those notes, rather, about folding circuits, flexible circuits.

Namely up to this time we were talking about rigid bases, and I believe it was in that letter, or subsequently that we did receive from the British, directly or indirectly, mention of folding circuits which to us was novel. This is an idea that never occurred to us.

There were not process details, as I recall, given in these notes, which I have here, other than to merely say that circuits were being made in England, by an etch foil technique, but what the etchant was, or what the bond was, that I don't think was in these notes.

Q The notes will speak for themselves, Mr. Danko, so we won't bother you with reading them at this point.

Do I gather from your testimony that other than the

foled circuitry you were aware of the techniques suggested by those notes?

A Yes, Kenyon, in conventionally speaking, had been pursuing that particular approach.

We fled that Beck was using that approach, as of that date, and we still did not know whether Beck was or was not.

But outside of the merely saying that this was a technique of etching of a foil laminate, that was nothing new in that sense.

However, it did indicate for the first time that someone in Britain was actually pursuing the etched approach, which was news to us up to that time. I don't believe we had heard that any such parallel work was going on in England.

Q Did you have any other contacts with printing and etching before your trip to RCA on May 25th, 1949, to your knowledge?

A No, I don't recall, and they do not show in any chronology over here, any other contacts relating to this particular technology.

Q Would you tell us then what occurred at RCA on May 25th, 1949?

A Well, again, to complete our Midwest survey, we contacted an east coast equipment manufacturer, RCA, and we were invited to sit with them and discuss the status and

future potentialities of printed circuitry.

We brought our samples with us, the collection representing the state of the art, and in a conference with perhaps four or five RCA engineers, we outlined the purpose of our visit, the work that had gone on, including the work at Kenyon, and the work going on at Balco and Herlec, and generally laid out the problems that we saw, the objective we were trying to reach.

They in turn took us to their production facilities, where they were making certain electronic components, namely turner coils, by etched technique.

We saw the actual production area, where such turner coils were being made, from the fresh copper clad laminate which I saw for the first time, and a photoresist operation, the etching, the cleaning and so forth, and the various steps involved.

At that time we were advised that this was a proprietary category. I don't think that they quite used that word, but it was privileged information, perhaps you might call it, and that we should not discuss the details of their process, and we did respect that request, and in my subsequent mention of RCA we did in fact refer to it merely as the RCA process, without associating it with etching at all.

It wasn't until subsequently, later in 1949, that we did get written permission from RCA to even refer to their

process as etching.

Then from there on we did identify RCA as using an etched process.

Q During your visit to RCA, Mr. Danko, did you become aware of any facts which would indicate the source of RCA's information?

A None. I do recall Mr. Mackey, Don Mackey, the engineer in charge of this whole operation. He and Dr. Black told me that they had been working with Synthane Corporation for Some time – I don't believe he identified the time period – on the development of a copper clad laminate, and to me, of course, I was quite enthused to see for the first time commercially what I thought would be commercially available a clad laminate of exceedingly fine surface texture, and apparently a good bond. The old fingernail test could be applied and there was sufficient adhesion to suggest that RCA had something there that was above and beyond the items that we had seen on the Kenyon contract.

Q Did you receive the impression or any indication as to whether or not this was an original RCA development, and by that I mean their use of these technique to make tuner coils?

A I don't think I probed RCA as to the origin of their concepts. It had been published, of course, by Kenyon in the National Bureau of Standards symposium proceeding, where he

had discussed the etched technique, and, of course, this was a practical running production line, which embodied usage, whereas previously Kenyon was searching and hunting for and approach.

Q I will hand you a brochure entitled "New Advances in Printed Circuits."

A Yes.

Q This is the U.S. Department of Commerce, National Bureau of Standards, miscellaneous publication 192, previously marked in evidence as Plaintiffs' Exhibit 39, and I will ask you to look at page 51 and tell us whether or not that is the Kenyon publication to which you refer?

A Yes.

Q Did anything else significant happen at your call at RCA?

A Well, the point that might be important here, is that RCA was confining its production strictly to inductors or coils.

At no time did we ever get from them any extrapolation of these techniques, into printed circuit harnesses. That is the idea that we approached to them, and suggested to them, was the problem that we were facing.

They then and there related what they were doing with the Synthane copper clad to this solution, that it portended – I hope I am using that word properly – to our ambitions, or our objectives, namely that here was a material

that possibly could solve some of the problems that we had so painfully gone through with Kenyon.

Q If I understand you correctly, you are testifying that you and Mr. Abramson suggested to them the extrapolation to boards from the pancake conductances?

A Yes. We were interested in the material that they had, in making printed wiring harnesses or printed wiring boards.

Q In order to preserve continuity, will you continue with whatever relationship you had with RCA after that date?

A We did then and there, as I recall, request them to give us some of their reject samples of copper clads, so that we could try these out ourselves. We did take them back, and they did give us several smaller pieces. We did take them back, and they did give us several smaller pieces. We did take them back, and they did give us several smaller pieces. We did take them back to the laboratory. At just about that time we did one in the chemistry laboratory. I don't remember what the resist was we used, wheter it was asphaltum, but I do recall we used some sort of resist, and we did actually etch out just to get a feel for the reality of this thing, and the fact that there was a fairly good bond with this material.

Frankly, this material to us was remarkable, if I may use an adjective that is strongly unusual, in that it was something that we had been looking for for quite some time, and here for the first time we actually did see a very smooth, clean looking, copper clad phenolic, in contrast to

some of the mutilated horrible looking things that Kenyon had made.

I had seen some of these efforts of his, and they were very amateurish looking. This was a very professional looking piece of material.

Q In your subsequent experience with that material, did it live up to its looks?

A Yes. Shortly thereafter Mr. Abramson received the idea, we thought it was original at the time, of resorting to an offset printing press for depositing the resist.

The reason for that is that the offset printing press has tremendous production capabilities. As fast as you can feed the material into the press, that is how fast it can put on the resist, an ink resist, and ink surface, on which you would then dust asphaltum, heat this asphaltum so it would liquefy, and form a good resist for subsequent etching with ferric chloride.

So pursuing Mr. Abramson's suggestion, we visited an organization called Etched Products in Long Island City.

After briefly explaining to these people what the purpose of our visit was, namely to try to print a resist, which was a new term to them, a new concept, namely applying it to printed circuitry, it was something new to them on this copper clad laminate, which they had not seen before.

We proceeded with a very simple experiment. We went

up to one of their offset printing presses, which incidentally happened to be printing bathroom scales, and stopped the presses, so to speak, and just looked at his laminated in place of metal that was in there, that was being processed, that was being printed. After a few adjustments for height, or whatever it was, they made one roll of the press over that thing, and we got this beautiful impression of black ink on the phenolic laminate, supplied by RCA previously.

Q You mean you had the bathroom scale on the copper clad?

A That's right. We had a bathroom scale on a copper clad.

They proceeded to dust asphaltum on there in their conventional way, and then put it into their continuous running bubble etchant's baths, and after a few minutes of etching, they were withdrawn to lo and behold, we did have a beautiful reproduction of this bathroom scale.

We did notice, however, that there was a slight wrinkling of the copper clad, which immediately did suggest that there was a defect in the bond, possible due to inadequate thermo resistance, namely the bond might have softened, and the copper expanded, and as a result it wrinkled.

But feeling as we generally do about these things, if the concept is sound, that the technology will follow to improve that, we felt the laminate could be improved. I never

had any doubts that further improvement could be made in the laminate.

To use this it was eminently successful since it pointed out that there we had the production aspect, covered and satisfactorily solved, so to speak. We could use an offset printing press, although the photoresist technique that RCA was using was also a substantial producer as a process.

So basically we had here what RCA was doing, and here is another idea of an offset printing press, both of which did suggest to us that finally perhaps we did find an answer here to our harness problem.

From then on we had several other contacts, a follow up with Etched Products, which never could quite appreciate why we didn't come to them before by Etched Products didn't possibly appreciate the fact that there was no copper clad laminate before available.

We followed up with Etched Products subsequently, and bought samples from them, as I recall, and they further refined their processes. They also were using some photographic techniques laying down the resist. It was common routine in their house.

Q Did Etched Products Corporation actually produce circuit boards or circuit harnesses for you?

A Yes, they did. I believe we did procure a number of

samples from them. It was subsequent to this date, of course. I would say at least six months afterward. We did supply them with patterns, master drawings from which they did make us boards.

Q I believe your testimony is that Etched Products viewed this as a whole new concept at the time you first approached them?

A No. Its application to printed circuitry was new to them.

Q Yes, that's right.

A Yes, they were in a decorating business, so to speak, making escutcheons and dial nameplates and dial faces and so on.

Q Will you continue and complete the RCA story, if there is anything left to tell?

A I don't know if there is much.

We continued our liaison with RCA. They were interested in what we were doing. First we had two activities going, one with Herlec and one with Balco, and they decided to continue this professional exchange of information. We fed them all the information that we had on a personal basis, principally through Mr. Mackey, and he in turn kept us abreast of their interests, in applying the techniques that they were then using into making harnesses.

I would feel objectively that we did suggest to them

the idea of using it in a printed circuit pattern, and that is the reason that they never mentioned patterns to us, inductors, that is, for interconnecting components before.

But subsequent to our visit we did concentrate on exchanging information on using copper clads for making conductor lines to interconnect components.

They were interested in our solder dip concept, which we subsequently talked about.

Q Before we get into solder dipping, and auto-sembly, Mr. Danko, when did you next hear of the British work, and more specifically the Henderson & Spalding people?

A The contact was in January, when we first heard of the British work. We asked for samples, if I recall, of Mr. Sprague, and it wasn't until the following July that we received a communication from a Mr. Strong, advising that he was interested in etched circuits, as I recall now, and that photographs would be forwarded under separate cover to the Signal Corps.

Q I will hand you a compilation of documents, which have been marked as Plaintiffs' Exhibit 60, and ask you if the top letter of July 8, 1949, is the letter to which you refer?

A That's right.

Q Please continue.

A We very much wished to continue this correspondence,

since this represented another input to the Signal Corps.

Here apparently was a British effort, along the same lines that we were concentrating on.

Their work looked very good, as we saw from the photographs that we subsequently received on 11 July.

These were photos of etched coils. These also had folded circuits, but these were not etched folded circuits. They looked like they were cut, with a sharp object, like a razor, and then cemented or otherwise attached to a flexible base.

There were no process details given again, other than identification of some of the photographs as being the results of an etched process.

We in turn wrote a letter back to them. I think that letter was considerably delayed because of vacations. It was 27 September, 1949. We replied to Mr. Strong acknowledging the samples.

Q Again referring you to Plaintiffs' Exhibit 60, is the letter of September 27, 1949, in that file to Mr. Strong, signed by A.W. Rodgers, the letter to which you refer?

A That's right. That is the letter.

We noted that we in the United States were simply progressing along the lines that he indicated to us in his letter, and as I recall, in that letter, that we expressed interest in the novelty of a folding circuit.

Now, this novelty, of course, is the second expression of novelty, because I seem to recall that in that first letter, the notes from -- we received from Sprague Electric Company that mention was made in those notes, which you showed me previously; I didn't examine them, that mention was made there about folding circuits.

Q I will read to you the second full paragraph appearing on Page 2 of the letter of September 27th, 1949, which is as follows"

"Our own experiences with processes similar to the Henderson-Spalding have proven the high production abilities of this approach. To date fabrications for the laboratories have been mostly based on the use of thermosetting plastics chassis and Teflon impregnated glass chassis for average and high temperature applications respectively. The use of your 'Foldable' circuits is novel and no work along such lines is known here."

Is this the portion of the letter to which you have referred?

A Yes.

Q Will you continue?

A The exchange between Britain and the United States, namely Mr. Strong and Mr. Rogers continued, and we did receive another letter dated 7 October, 1949, from Mr. Holman, in which he requested a copy of our Bulletin 102,

which had been issued about a month and a half before, and which I think we referred to in our previous -- some how he knew about the 102, I am just wondering whether we told him about the 102, or how he found out about it.

Q Just a moment, Mr. Danko, I think I can find it for you.

In the letter of September 27, ’49 from Rogers to Strong, the following appears in the third paragraph of the first page:

“A recently issued bulletin identified as ‘Components and Materials Branch Bulletin 102, Squier Signal Laboratory, Signal Corps Engineering Laboratories’ summarizes the opinions and trends in the Signal Corps on the subject of printed circuitry. This bulletin should be available to you through the British Liaison Mission, which has representation here in Fort Monmouth.”

A Well, apparently, then, this is where he knew -- how he knew about Bulletin 102.

In his letter of 7 October, 1949, he asked for a copy and also advised for the desires of this firm to have representation in the United States.

Q Did you have further dealing with Henderson-Spalding?

A Yes. We continued the exchanged of correspondence.

The next note I have is on 19 October; is a letter

to the Director of Squier Signal Laboratory from Technograph forwarding a sample of a flexible circuit.

This letter was interesting in that the folding circuit was on a polyethylene base. This is a thermoplastic, namely it distorts on the application of heat.

The letter included a -- this folding circuit included a few resistors, which had been soldered to the surface of this pattern, and was intended to exemplify a method of attachment of electronic components to a plated wiring board made by our technique.

I might express an opinion on our part that although this work was very fine inso far as the printed wiring was concerned, it was a very nice job, we, of course, were not interested in polyethylene. Polyethylene would not be permitted in our operation. It was too easily distorted by heat, as I said, and we were committed in our own minds, to soldering components onto such a printed wiring configuration.

As a matter of fact, the samples that hey had sent us seemed to be somewhat damaged from the heat used in soldering the resistors to the polyethylene.

And I expressed ourselves, subsequently, but, perhaps to finish with this letter, we kept asking them what would be the next step with regard to making circuits from these boards, and the form of soldering was raised, and we were most interested in knowing what their thinking was on

assembly purposes.

After all, the board by itself is useless if you can’t do something with it; it was a component, that is one element to a circuit to us, so, the assembly operation was very important. We had already conceived the thing we called Auto-Sembly, whereby conventional components with pig-tail leads could be dropped through holes, perforated in the printed wiring chassis, with the wiring on the under side, and then, in a single operation, joining every one of these protruding leads to the copper pattern in a molten

solder bath, kiss the back, so to speak, for five seconds or so, and effecting all of the joints at one time.

This is what we told them in our Bulletin 102. This was the Signal Corps' concept of the usage of these boards, and we were most interested in hearing from them what their answer was, how would they do it, this next step.

Once again, we were inviting a professional exchange. And I think it was a very useful exchange, in a sense that we did get their thinking.

They included -- they made the statement in this letter of 19 October to the effect that, although they had mentioned or made reference to stapling of component leads to the printed wiring pattern, this was not a feasible -- I don't know if the word used was feasible, but it was not

feasible in connection with copper wiring.

Q Please look at my copy of Plaintiffs' Exhibit No. 60, which I will hand you, and I will show you the letter of 19 October, 1949, and specifically invite your attention to the third paragraph on the first page.

Is that the portion to which you refer?

A Yes.

And, remembering now, that we had asked them about this hot stapling technique which we had heard, or read they desired to use, and their response in this letter of 19 October 1949 reads as follows:

"We do not consider that hot stapling components to circuits of copper on polythene to be a practical proposition, or at least we have not hither to seriously contemplated this technique for the polythene material.:

Their ultimate suggestion, apparently, was to solder the components, because this is what they did on the sample they submitted in that same letter.

Q Mr. Danko, would you please read the first sentence of the following paragraph into the record?

A "We should like to explain that these polythene circuits are still in the early stages of development and it may be that eventually spot-welding or something similar to that might ultimately prove the better method."

Q Please continue.

A Apparently it was our turn to reply to Britain, and we did in a letter of 8 November, 1949.

Q I'll show you --

THE COURT: Now, wait a minute.

MR. BIRCH: Excuse me.

THE COURT: You can't reply to a November 19th letter on November 8th.

THE WITNESS: The 19 October letter is the letter we had been discussing.

THE COURT: I am sorry.

THE WITNESS: And our reply to that letter was dated 8 November, 1949.

Q I show you again the compilation that has been marked as Plaintiffs' Exhibit 60, and ask you if this is the letter appearing under date of November 8th.

A Yes.

We, in that letter, we advised that there were United States sources of laminates, the specific reference was the Synthane Corporation, and, since our first exposure to the Synthane copperclad laminate, I think that by that time there was another source of supply. Some how, I think it was National Vulcanized Fiber, possibly, or some other laminator.

Anyhow, there was one other source of supply at that time, and we may have told them about one or both sources

of supply.

Q I invite your attention to Paragraph two in the letter of November 8th, 1949, and I will ask you if that is the portion of the letter to which you have referred?

A Yes.

Q Please read it.

A The part that pertains only to Synthane?

Q That was what you were discussing --

A Yes.

Q -- I believe Mr. Danko.

A Yes.

"You may be aware that such laminates are available commercially here in the States. The Synthane Corporation, Oaks, Pennsylvania, sells a laminate with 0.00135 mils or 0.003 mils copper foil bonded to 1/16th inch or 1/8th inch XXXP phenolic, one of two surfaces, and sheets up to 36 inches by 36 inches. A sample of this material will also be forwarded to you."

Q Mr. Danko, there is an interesting sentence in the first paragraph of that same letter, where you state, or at least somebody of the Signal Corps states that "there appears to be some features which are common to the 'Technograph' and the 'Auto-Sembly' systems, primarily in the use of live metal conductors and separately fabricated components."

Now, we have dealt with this word "live metal" before.

Are you the originator of the term?

A I'm sorry to say I am.

(Laughter)

Q Would you please tell us what you meant by it?

A We meant two things.

We used that term to identify a conductor which had attributes of the virgin metal, specifically with regard to conductivity and appearance. Actually the word

"appearance" bothers me a little bit; I would rather say that the second attribute, as I think a little more about it, now, would be the solderability.

We coined that word "live" to try to draw the association to the virgin metal.

The reason for coining a new word is to draw a distinction between that type of conductor and the type such as Centralab was using, where they have a silver powder in a binder, and by a heating process reconstitute the conductivity -- the electrical conductivity of a deposited line, and that in the Centralab silver deposited line or conductor wouldn't have pure metal within that line. There was some binder, some residual binder, or it might be porous. In this particular case both Technograph and the Signal Corps shared the belief, I am glad to say, that a good conductor is one which is live according to my definition.

The term, apparently, has been picked up subsequently

by some of the laminators and some of the people in printed circuit activities, and I never felt that there was any quibbling, so to speak, about what was meant by "live."

It was meant, intended to have a connection by the specific definition involving conductivity and, I would say, solderability, these were limited to the types of patterns that the English and we were making.

Q All right.

Will you continue in your account of your further relationship with Henderson-Spalding?

A This letter to Technograph, which we are still discussing, 8 November, 1949, also made reference to a British report which we had received through other channels about trouble with bonding.

Now, I don't recall the date of that report, but, apparently the English were having trouble with bonds. Apparently the bonds were not satisfactory to them, and I would be willing to grant that we weren't satisfied, either, because we wanted to improve those bonds. I think we were communicating with Synthane Corporation during this period, pointing out that their bonds were not fully satisfactory for the solder dip operation. Sometimes the bonds were good bonds, sometimes they were not. And I think we wrote a letter, or two letters, possibly, to Synthane, pointing out that we, as a potential user would wish to see a better bond.

And the English also apparently had problems with the bonding.

Q Mr. Danko, I hand you a report entitled TRE Technical Note No. 36, and I ask you whether or not that is the report to which you have referred, and if you wish to look at the letter of November 8th, 1949 --

A Yes, I have no doubt that is the report. I haven't seen this report in all these years, and I don't recall specifically what is in it, but at the time I wrote that letter apparently I had just gotten through perusing it.

Q Do you place in the point of time the receipt of that report to sometime just prior to November 8th, 1949?

A Yes, I think the fact that I used the words "just recently" would suggest the fact that we had received one I would say within a month.

Q I would invite your attention to the last page of that report, Mr. Danko -- I think it is before the drawing and graphs, the report proper, and particularly to the material under numerical paragraph 7 "Acknowledgements" and the fact that Messrs. Henderson and Spalding are there listed (indicating).

A Yes, they are so listed.

MR. BIRCH: I will offer the TRE report identi-

fied by the witness in evidence.

MR. BLENKO: No objection, but, let it be noted that the date appears on the last page which is June, 1949.

THE CLERK: Defendant's Exhibit No. 462.

(Thereupon, TRE technical note No. 36 was marked Defendant's Exhibit No. 462.)

BY MR. BIRCH:

Q Can you recall, Mr. Danko, whether or not you are certain you had received the TRE 36 shortly before November 8th, or whether or not you had received it as far back as June?

A Well, I don't think we would have gotten it in June. The channels of communication with Great Britain were such that I would estimate it would take at least a month for it to reach us, assuming that it was issued on the date that Mr. Blenko indicated, 8th of June, you say?

MR. BIRCH: I believe there is a date in June, isn't there, Mr. Blenko?

MR. BLENKO: That is right.

BY MR. BIRCH:

Q All right.

Will you continue?

THE COURT: Well, we will have to stop sometime and this might be a good time to do so.

I was wondering, I am going to have to adjourn promptly at 4:00 o'clock. Is there any chance that Mr. Danko can be finished if we cut the luncheon recess short?

MR. BIRCH: I think so, Your Honor. I don't have a great deal more. There are some other items I wish to take up with the witness.

THE COURT: Can you do it in half an hour?

MR. BIRCH: I think I probably can.

THE COURT: I mean can we have lunch in a half and hour?

MR.BIRCH: Oh, I am sure we can do that.

THE COURT: Well, let us try it.

2:00 o' clock.

(Thereupon, at 1:30 o'clock, p.m., a recess was taken until 2:00 o'clock p.m.)

- - -

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MARYLAND

Technograph Printed Circuits, Ltd.
And
Technograph Printed Electronics, Inc.

Vs. No. 11421 Civil

Bendix Aviation Corporation

Transcript of Proceedings Before Hon. R. Dorsey Watkins, Judge

Volume: 22-A Date: November 21, 1961 Pages: 2834 to 2993

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Official Reporter
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I N D E X

Witness	Direct	Cross
Stanislaus F. Danko (Contd.)	2838	2963

E X H I B I T S

Plaintiffs' Number	In Evid.
438. Information Bulletin No. 19	2970
439. Third Quarterly Report of Herlec	2984
440. Balco Quarterly Report	2985

Defendant's

Number

463. File History of Abramson & Danko application 2947

464. Patent 2,756,485[9] 2947

465. National Electronics Conference 2956

466. Article Printed Circuits for Military Equipment 2957

467. Article Printed Circuitry for Transistors 2958

468. Paper delivered at IRE 2958

454-A. Glass Products letter 2959

423-A. Letter Beck to Signal Corps 2960

469. Sample Part made by Pritikin 2962

AFTERNOON SESSION

THE COURT: Good afternoon.

Mr. Birch.

BY MR. BIRCH:

Q Mr. Danko, before the luncheon recess you had been considering the correspondence which had been exchanged between the Signal Corps and Henderson & Spalding in England, and I believe the last item to which you referred was a letter of November 8th, 1949, if I am correct.

A Yes.

Q Would you please continue in your discussion of what occurred between the Signal Corps and Henderson-Spalding?

A Well, we received a reply from Technograph dated 8 December, 1949, and the highlights of that letter are the following:

The British mentioned limited availability of foils in England. Their preference for polyethylene bases, and they raised some questions about the feasibility of

[9] Attached Note - Patent 2,756,485 ordered on 10/22/64 from Mrs. Haggins X-61584 will be available in about 2-3 wks. To be sent to S. Danko.

the Signal Corps' solder dipping operation as applied to stiff laminate chassis. And I don't recall much --

Q Is the letter which I have here in my copy of the Plaintiff's Exhibit No. 60 the Technograph 8 December, 1949 letter to which you refer?

A Yes.

Q I see on page 2 of that letter, under numerical 3,

the following:

"We are very interested in the solder dip technique you have tried on the Auto-Sembly plates, and, noting that the sample that you sent shows the same defects we had ourselves encountered when trying to do a similar process, we make the following observations:

"In your sample there are numerous solder bridges in the close pattern of the lettering. There is one instance of a bridge joining the letters N and E in 'engineering' and another in which the letters P and R in 'process' are similarly joined, and several places where the letters have filled up. As our experience in dipping gave the same defects, we concluded that this method could not be used safely where a close pattern, or fine lines closely spaced, were concerned."

Is that the disclosure to which you have referred?

A Yes.

Q Were you in agreement that the solder dipping process developed by the Signal Corps was defective?

A May I refer to the text again?

Q Surely.

(Hands document to the witness.)

A I think they qualify that by saying that where close pattern or fine lines closely spaced were concerned.

It is possible where those lines are too close to

actually get such bridging as they indicated. However, their comment doesn't seem to be made with respect to the line work, but they seemed to be concerned with the unusual fine lettering that went along to describe the plate.

Now, this lettering was etched on the plate merely as identification, so, their criticism isn't of the line work, which is what is important, but of some very fine lettering.

And I certainly do concede and I agree with them that where very fine line work is concerned, solder dipping may cause trouble, but that is not within the limits of the Auto-Sembly where we so allow some reasonable spacing for other reasons, dielectric failure protection, we do separate the lines a certain amount.

Q The next sentence is interesting, it is as follows:

"We also noted that the letter 'i' in Engineering had entirely disappeared, probably for the following reason -- then there is a discussion of the failure of the adhesive, and particularly Hycar.

Do you have any comment with respect to that statement?

A Well, because the letter 'i' was missing, they concluded that it was the failure of the thermoplastic compound. Actually we had one of those unfortunate situations that happens every so often, that in drafting up the master for

this particular printed wiring plate, the work "engineering" was misspelled, and it actually came out e-n-i-g-i-n-e-e-r-i-n-g". And, being the purists that we are, we pulled off one of the surplus i's before we distributed these, and it might have prompted this particular comment. Now, it is a question of which "i" was lost, and there were apparently three i's on there.

But, however, we must be fair about this observation here, I certainly do agree that this was a compound which was not ideal. As far as we were concerned, the adhesive bond that was then available was fair from the viewpoint -- from our analysis of it at that period of time, namely, it withstood solder dipping sometimes and sometimes it did not. There was a matter of uniformity to be resolved on here. I think we did communicate with Synthane on this problem, so, therefore, let us certainly be fair about our observation of weakness in bonds. So, there is no argument with the statement that he makes that this can sometimes happen that the thermoplastic -- actually I am not so sure that was a thermoplastic in the true sense, I think it was a combination, which loosens in the temperature required in dip soldering.

Q Was there anything further in your relationship with Henderson-Spalding which is pertinent to the development of information?

A We continued this, what I considered very informa-

tive exchange, with the reply dated 2 February, 1950, in which we furnished information on Synthane laminate and on the Signal Corps solder dipping technique, and it is possible that in the letter we may have tried to explain the missing "i", I am not sure.

Q I believe the third paragraph on page 1 of that letter the following appears:

"The letter I in 'engineering' was purposely removed in many of our samples due to a misspelling in the draftsman's copy --"

MR. BLENKO: Will counsel kindly read in the entire paragraph?

MR. BIRCH: Surely.

The third paragraph in its entirety reads:

"With regard to your comments on the solder dipped specimen forwarded to it, it is agreed that where very fine close-spaced wiring is involved, solder dipping may result in bridging. The circuit applications contemplated, however, will not require such fine spacings, in general, but if such spacings must be used, high temperature adhesive masking tape can be used as a solder barrier. It should be noted that the tinning of the entire pattern is incidental and not necessary, the only points of concern for soldering

being the component junctions. The letter I in 'engineering' was purposely removed in many of our samples due to a misspelling

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in the draftsman's copy; it may be that the wrong I (or both of them) have been removed in the sample forwarded. We have not experienced trouble on this point."

I note a letter of February 10th, 1950, from Hermoplast, which is unsigned -- incidentally, for the reason that all of the documents that I hold in my hands were produced from Technograph's files.

Do you recall seeing that letter (indicating)?

A Yes.

Q Would you read the first paragraph, please?

A "We thank you for your letter dated the 2nd February, forwarded through the joint service mission, and we are grateful for the information you have given. We had supposed the copper foil used by the Synthane Corporation must be electro-deposited in such widths."

Q Will you read the second paragraph?

A "Unfortunately we do not enjoy the benefit of having any such raw material ready for our use, and have to do every type of lamination work for ourselves, before we can start to make circuits."

MR. BLENKO: Will you kindly read the fourth paragraph?

MR. BIRCH: The fourth paragraph reads, "In fact, we have achieved reasonably good bond strength to class fabric, but we are not yet entirely satisfied."

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Q Do you have any other recollection, Mr. Danko, that would be important to this general field with respect to the contacts you had with Henderson-Spalding?

A Well, it seems that our correspondence ceased at that point, and the only other contact that I could locate of record is a letter of 15 June, 1951 addressed to A.W. Rodgers from Technograph, giving notice of assignment of patents to Technograph, and apparently expressing an interest in doing some work for the laboratory.

Q To your knowledge, has Technograph ever done any work for the laboratories?

A Under contract, I presume you mean?

Q That is what I intended.

A No.

Q Do you have, or have you ever had any knowledge of any production capability on the part of Technograph at any time?

A From the literature --

Q American Technograph 00

A -- that they had distributed, I did have one specific of their capabilities.

Q Do you mean American or British Technograph?

A American.

Q What was that indication?

A Well, as I recall reading some of their promotional

material -- and I don't mean that in a derogatory way -- they did indicate that they had substantial laboratory and production space in Tarrytown. I think Mr. Shortt subsequently elaborated on those facilities for us. And I do recall that we even had photographs of their facilities and areas of work submitted in connection with a proposal to -- a Signal Corps proposal to which they responded. So, from the Technograph people we had an input of what they had, but that is what they said.

Q In other words, of your own knowledge you have no knowledge with respect to commercial production of any type by American Technograph?

A No. I have no idea how much they were producing.

Q You mentioned the Synthane Corporation, Mr. Danko, and your relationship with them, can you recall anything specific with respect to the development of laminate in conjunction with Synthane?

A Well, we apparently wrote them several letters. There is a letter of 10 October, 1949 (we were already solder dipping then) in which we made some comments about Synthane laminates which we were purchasing, or we had recently purchased. I don't know if there was anything particularly informative, but you asked me if there was any exchange. On 10 October there was a letter to Synthane.

Then I do recall another letter generally about the--

in which we pointed out the weakness -- yes, this letter is dated 21 February, 1950, a letter to Sythane signed by Mr. Kublin of the Signal Corps, expressing his desire to have a better laminate.

Now, as time went on we became a little bit fussier about our requirements.

As I pointed out initially, you first try to overcome a problem by the brute force approach. We were first interested in this laminate because it withstood solder dipping. Having initially overcome that hurdle, we then started examining some of the other attributes that we would like to have, leakage, for example, warpage, lack of reproducibility, and these are things that we were checking out continually on commercially available laminates, and we were gradually tightening up our requirements.

We got to know the laminators a little bit better, and as improvements were made we assisted them.

We were continually exchanging information with laminators and with other people who were using these laminates, such as RCA, for example.

So, the letter of 21 February, 1950 did express the Signal Corps' desire to have a better laminate.

Q On that point, Mr. Danko, will you tell the Court what your problems were with bond through the years starting with the laminates that you had available to you from ex-

perimental sources, the first laminate you saw from Synthane and the laminate as it developed? And by laminate I mean copper clad.

A Well, our initial concern, which was not obvious to us immediately, was the fact that there was a lack of reproducibility from batch to batch, or whatever way we received those items from Synthane. Some were excellent, some were fair, some were poor. Some, as a matter of fact, could be pulled back very easily by just getting under the foil and pulling it back very easily.

As a result, we were using a pull strength test, and we used that as a basis for -- as a yardstick by which to evaluate the pull strength. There was a one-inch strip which we cut on each side, right through the copper foil, right down to the laminate, and then peeled back on a Scott tester. And, generally we were getting pulls, as I recall, of the order of a few pounds for a one inch test strip.

And there were times, I think, as we progressed, as Synthane and the other laminators progressed in their techniques, that we were getting higher and higher pulls, and I think somewhere on the order of five pounds was finally accepted as a minimum to the Signal Corps.

Subsequent work by -- support work by the Signal Corps with the Houghton Laboratory -- this was, I imagine, somewhere around the mid ‘50s, or probably a little before,

this Houghton Laboratory effort was subsidized by the Government in an effort to overcome a chronic bond problem, that was evident in the commercial laminates, mainly because progress was not being made to the degree that we desired, so we were willing to support some research and development with Houghton, to see if they could improve that bond.

They did come up with a process which involved oxidizing the under surface of the copper prior to lamination, I think it was prior to lamination, which, in effect, did yield a greater pull, I don’t know what those pulls were, it seems that they were something above ten pounds. I do not seem to remember now what the problems were which limited its usefulness, but it did not find extensive commercial usage, and I, at the moment, cannot recall why, whether it was surface leakage or what it was.

Q Mr. Danko, as of the time you saw the first Synthane copper clad, would it have been possible on the basis of the information you had to have employed that laminate satisfactorily in mass production using the solder dipping process?

THE COURT: This is before the first Synthane, is it?

MR. BIRCH: No, Your Honor -- well, certainly before, I think he has testified to that, but, I am asking him

if he could have done it with the first laminate he saw.

THE COURT: I see.

A This is, of course, opinion, I think it could have been in a mass production basis, but there would have been a lot of rejects, in other words, it might have been a costly process, the cost being involved in throwing away the laminate possibly with circuits already assembled to them, unless some better test was devised to weed out the good laminate from the bad laminate. The lack of reproducibility from a practical production point of view would have been considered serious.

Q Mr. Danko, you have mentioned the development of the Auto-Sembly process, and you have told us what it entailed. I believe you have also mentioned that a patent application was filed covering that process.

I will hand you a certified file history obtained from the patent office and ask you if this is the application to which you referred?

A Yes, this is the material.

Q And that application was filed by you and Mr. Abramson together; is that a fact?

A Yes.

MR. BIRCH: I offer the file history of the Abramson and Danko application, identified by the witness, in evidence.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 463.

(File history of Abramson and Danko application was marked Defendant's Exhibit No. 463.)

BY MR. BIRCH:

Q I will hand you a copy of the United States Patent 2,756,485, to Abramson et al, do you recognize that patent?

A Yes.

Q Is that the patent which issued on the application just identified?

A Yes.

MR.BIRCH: I offer United States Patent 2,756,485 to Abramson et al in evidence.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No, 464.

(Patent 2,756,485 was marked as Defendant's Exhibit 464.)

BY MR. BIRCH

Q Mr. Danko, there is one other area I wish to develop with you, and that is the use of a metallic resist in the production of printed circuitry.

What, if anything, was done at the Signal Corps in that connection?

A When you say at the Signal Corps, may I also include by the Signal Corps?

Q Yes, anything that you know of as a result of the Signal Corps activity.

A Well, Mr. Tuttle of Kenyon Instrument Company filed a memorandum for patent reasons on September 19, 1947.

This memorandum was filed in what we called a contract notebook, which he maintained, during the first year, or certainly during three-quarters of the first year of the contract.

In this memorandum, as I recall, he describes a technique which is as follows: He deposited --

MR. BLENKO: This is objected to as not the best evidence.

MR.BIRCH: Not what?

MR. BLENKO: Not the best evidence.

BY MR. BIRCH:

Q Do you know, Mr. Danko, just to avoid this objection, whether or not that particular technique appeared in

the Kenyon reports?

A No, I think not. I don't recall it.

Q I seem to recall some such disclosure. Let's see if we can find it, and I will direct your attention to it.

While we are looking at the reports, I will again hand you the Bureau of Standards Bulletin 192, and invite your attention to the second full paragraph appearing on page 53 in the second column and ask you if that is the technique to which you refer?

A I am familiar with this paragraph.

Q Is that the technique to which you refer?

A Yes, that is the paragraph, and that is the technique.

Q Proceed with your description based upon that record then.

A I was going to describe the process, as it was described in this memorandum, and as is presented here in essentially the same substance.

The process involved depositing an alloy of nickel aluminum and chromium on an insulating surface.

A second layer of metal, specifically silver, was then deposited over this first metal layer. A resist, photoresist, was then superimposed on this silver surface, and with appropriate etchants the silver that was not covered was

removed.

The underlying and now exposed nickel chromium aluminum alloy, was not attacked by this etchant.

The next step was to expose this process laminate to a second etching bath.

The second etching bath proceeded to etch down to the bare insulating board, removing the previously exposed nickel, chromium aluminum alloy.

In that fashion it was possible to end up with, as an end product, a silver covered pattern, such as you may desire.

Mr. Tuttle did use the term “metal resist,” as I recall in the document New Advances in Printed Circuits, that I am looking at now.

It does specifically say that the silver image acts as a protective resist for underlying base metal.

Q Mr. Danko, I will hand you the second quarterly report under date of 15 December, 1947, for the period of 15 September, 1947, under the Kenyon Instrument Company, Signal Corps contract, and invite your attention specifically to page 4, sub-title B, the silver resist process, and under that you will note sketch sheet No. 152, inventor Clifton M. Tuttle, method of producing electronic circuits on electrical parts, and I will ask you if that section of the report describes the process you have just read.

A This is the memorandum that I made early reference to.

My recollection of it, as being in the notebook, which I know it is, was prompted by the physical layout of the sheet.

I did not recall that it was in the report, but I do agree that it is there.

THE COURT: What is the date of that report?

MR. BIRCH: The date of this report is 15 December, 1947, for the period of 15 September.

THE COURT: The second report?

MR. BIRCH: The second report.

BY MR. BIRCH:

Q What other experience did you have at the Signal Corps with the use of a metallic resist?

A We have an in-house document, which is a trip report by a Mr. Pearlmann, who preceded me as the project engineer, and on 8 January, 1948, Mr. Pearlmann’s trip report notes the use of cold top as a masking stop for depositing the silver selectively, whereas Mr. Tuttle envisaged covering the entire plate with silver, Mr. Pearlmann’s trip report notes some consideration of using a cold top or a more selective deposition of the silver.

This possibly might suggest that instead of a positive image, it is a positive image of the negative. I am

not sure. There is no reference in the note that we have in the Signal Corps file.

Then three years later, on 11 June, 1951, a Mr. Bornemann, a technician who worked for me, filed a silver resist disclosure in his patent books, and this was subsequently processed through our patent advisor, and we were informed in May, 1952, almost a year later, that the patent agency would not process this particular disclosure, and cited a number of references of prior art.

Q Can you tell us whether or not the Bornemann disclosure or the Bornemann process did or did not involve metallic resist?

MR. BLENKO: That is objected to as not the best evidence. I think he should be here.

THE COURT: Sustained.

BY MR. BIRCH:

Q Do you have the report with you, Mr. Danko?

A No, this is in the Signal Corps custody.

Q Can it be purchased?

A I am sure it can. I can certainly make the overtures, and I see no reason why not.

It does involve another agency, other than mine, that is, namely the patent agency, patent activity, and I suggest that possibly through your previous contacts, whereby you were getting the copies, you might inquire as to avail-

ability of the silver resist disclosure by Mr. Bornemann.

MR. BLENKO: If that can be done, I think that the Pearlman trip report should also be included.

MR. BIRCH: By all means. I think we should get them all.

Will counsel agree that if the Pearlman trip report and the Bornemann disclosure are produced by the Signal Corps that they may be admitted without objection as authentic?

MR. BLENKO: I will have no dispute about authenticity. Of course not.

THE WITNESS: Sir, may I suggest something?

The Pearlman report is an in-house document. It is a report from the engineer to his supervisor, and as such it may contain other material in there that is not pertinent to what is being discussed right now.

I don't know if it is proper. May I suggest that if on perusal we find reasons why other material in that report which is not germane to what we are discussing over here, it can be removed and so certified that the material removed from that report is not related to this silver resist, which is, incidentally, only a few sentences that possibly may be considered.

MR. BLENKO: The plaintiffs will make no objection to that procedure.

THE COURT: Very well.

THE WITNESS: Between the time that Mr. Bornemann filed his disclosure, and the time that our patent advisors told us that it would not be processed, we did make some photographs, detailing the silver resist process of Mr. Bornemann's.

I prepared a paper, as a matter of fact, in September of 1951 for presentation at the National Electronics Conference in October, 1951.

This paper was cleared by the cognizant authorities at Fort Monmouth, and the paper was presented in Chicago, in the period 22 to 24 October, 1951 by myself, in which I detailed this metal resist process, as defined by Mr. Bornemann.

Q I will hand you a copy of the proceedings of the National Electronics Conference Volume 7, Chicago, Illinois, October 22nd, 23rd, and 24th, 1951, and ask you if that is the document or the paper to which you refer?

A Yes.

Q Would you please point out the pertinent disclosure in that document?

A Figure 15 -- no, figure 13. Any text related to figure 13 would cover the subject we are discussing now.

Q Were there any other pertinent activities with respect to metallic resist in the Signal Corps, to your knowledge?

A None.

After being advised by the patent agency that they would not process this disclosure, we closed our files, and we practiced the art thereafter on a small scale, as needed to some in-house developments.

Q I note on the page 549 of this paper, Mr. Danko, under heading 7, other applications of Auto-Sembly, under No. 2, the following: Ethced parallel line patterns have conductors on a stiff or silicon base, and can be used as Faraday schields.

Would you tell us what experience the Signal Corps had with Faraday shields produced by etching?

A Well, we may have occasionally etched a Faraday shield for exploratory purposes. Shields were used sometimes in transformers, between layers, to provide electrostatic shielding from one coil to another.

But I must say that we did very little along those lines.

In that particular text I was making reference to projections.

We actually made configurations that looked like Faraday shields. They were long fingers.

It is a pattern with just long fingers of conducting metal opened at one end and shored at the other.

But in that list that you were referring to, in that text, I was extrapolating future applications, namely suggest-

ing to the audience how etching of laminates could be exploited.

MR. BIRCH: I offer in evidence the proceedings of the National Electronics Conference identified by the witness.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 465.

(Proceedings of the National Electronics Conference was marked Defendant's Exhibit No. 465.)

BY MR. BIRCH:

Q Mr. Danko, I will hand you a document which has been marked as Defendant's Exhibit 458, entitled Auto-Sembly of Miniature Military Equipment, by S.F. Danko, and S.J. Lanzalotti. Did you collaborate in the authorship of that article?

A Yes.

Q Does that article describe the Auto-Sembly process as you have testified here today?

A Yes.

Q I will hand you two other documents and ask you if you can identify them. The first one is entitled Printed Circuits for Military Equipment, by S.F. Danko, which was a paper presented at the symposium on ceramic dielectrics held at Rutgers University, New Brunswick, New Jersey, April 18,

1952, and later published in Ceramic Age in October, 1952. Can you identify that?

A Yes, I am the author of this article.

MR. BIRCH: I offer in evidence the article identified by the witness.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 466

(Article entitled Printed Circuits for Military Equipment was marked as Defendant's Exhibit 466.)

BY MR. BIRCH:

Q I will also hand you a document entitled Printed Circuitry for Transistors, by S.F. Danko, which was taken from the November proceedings of the IRE. There should be a date on this thing. Can you identify it and perhaps find the date?

A I think it was 1952.

Q It says that the original manuscript was received by the institute on July 10th 1952. Can you identify that?

A Yes, I am the co-author of this article.

MR. BIRCH: I offer in evidence the article identified by the witness.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 467.

(Thereupon, an article entitled Printed

Circuitry for Transistors was marked Defendant's Exhibit No. 467.)

BY MR. BIRCH:

Q I have a third article, too, Mr. Danko, entitled Signal Corps Engineering Laboratories, Fort Monmouth, New Jersey, Miniaturization Technique, a Discussion and Proposal.

It is a reprint of a paper delivered at the component section, Institute of Radio Engineers Convention, March 9th, 1950.

Can you identify that article?

A Yes, that is the first public presentation of the subject to the electronics industry.

It preceded those others.

MR. BLENKO: May I see that?

MR. BIRCH: Surely.

MR. BLENKO: No objection.

THE CLERK: Defendant's Exhibit No. 468.

(Thereupon, a paper delivered at the Institute of Radio Engineers Convention March 9th, 1950, was marked as Defendant's Exhibit No. 468.)

BY MR. BIRCH:

Q Mr. Danko, I have one more item to discuss with you.

On Friday, following the preparation of a letter by

local counsel, Mr. Avirett and Mr. Howard, I called Mr. Glassman to determine for sure whether you were going to arrive here today. I read the letter over the telephone to him. That letter requested the production of several items of correspondence from the Beck files, principally, and I believe one from the Glass Products file.

MR. BLENKO: That is right.

Q Were you able to find those letters?

A Yes.

Q Do you have them with you?

A Yes.

Q Would you produce them please?

A I have three copies.

MR. BIRCH: Would Your Honor like to look at a copy?

THE COURT: Yes.

(Document handed to the Court)

MR. BIRCH: Your Honor, counsel have discussed the problem of marking these other letters, and if it pleases the Court, we would like to offer the four Glass Products letters as a new exhibit with an "A", that is, Defendant's Exhibit 454-A.

MR. BLENKO: No objection to the exhibits.

THE CLERK: Defendant's Exhibit No. 454-A.

(A group of Glass Products letters

were marked Defendant's Exhibit No. 454-A.)

MR. BIRCH: The Defendant's offers in evidence as Exhibit 423-A, the letter of November 12th, 1949, to the Signal Corps from Mr. Beck.

MR. BLENKO: No objection.

MR. BIRCH: The record probably should also reflect the dates of the letters that were marked as 454-A.

The first is a letter of March 14th, 1950, to Mr. Kublin from Mr. Pritikin, with an attachment apparently reflecting the forwarding for seven samples of printed circuits.

A letter of June 1st, 1949 to the Director of Squier Signal Laboratories, Fort Monmouth, from Mr. Pritikin, and a letter of March 24th, 1950, to Mr. V.J. Kublin from Mr. Pritikin.

THE CLERK: The letter from Mr. Beck to the Signal Corps is marked Defendant's Exhibit 423-A.

(Thereupon, a letter from Beck to the Signal Corps was marked as Defendant's Exhibit No, 423-A.)

BY MR. BIRCH:

Q Mr. Danko, in looking at the letters just produced, and particularly at the December 15th, 1949 letter to you from Mr. Pritikin, I not a request for a proposal to make 300 parts for your Auto-Sembly unit. Were those 300 parts

ever made?

A Yes.

Q Do you recall what they were?

A I have a sample of it with me.

Q Will you produce it, please?

A I should have it. I had it yesterday.

Q Mr. Pritikin's letter says, "the specifications call for either embossed or inlaid. Have you any preference, as we can make either one? The embossed part would be practically identical to the part you showed me, made by the Etched Products Corporation sample of which is enclosed."

Do you know whether this sample was made by the inlaying or embossed process?

A That is what was identified as an inlaid item.

Q And that would make it similar to the commutator that you had identified before?

A Yes, in the sense that the bottom conductor is subsurfaced. This is not resting on a surface; it is flush.

Q Is there any objection to our marking this as an exhibit?

A No, this is one of 300, and we used those for test purposes and so on. This is certainly expendable.

MR. BLENKO: No objection.

MR. BIRCH: I offer the sample of one of the 300 parts produced by Mr. Pritikin as referred to in the letter of

December 15th, 1949 in evidence.

THE CLERK: Defendant's Exhibit No. 469.

(A sample part made by Pritikin was marked as Defendant's Exhibit No. 469.)

BY MR. BIRCH:

Q One further question, Mr. Danko.

When did you first hear of, or maybe more specifically I should say when did you first have in your possession a copy of Eisler patent 2,441,960?

A I would say very shortly after Mr. Enslein of Stromberg-Carlson brought to our attention the Eisler patent in a telegram, sometime in 1949.

29 September, 1949.

Q I hand you Defendant's Exhibit 461 once more, and call attention to a telegram, which is addressed to the Signal Corps Laboratory, Attention Mr. Abramson from Enslen, Stromberg-Carlson.

Is that the telegram to which you refer?

A Yes.

MR. BIRCH: No further questions.

THE WITNESS: Sir, may I ask a question again?

With regard to the availability of these notes, Pearlman's note, I just recalled again that if we can supply those without this blue ribbon certification, we can certainly expedite considerably the availability of these documents.

MR. BLENKO: Let the record show that both Mr. Classman and Mr. Brody are in the Court room have been here all day. I will say, not only to the Court and to the witness, but to them, that if either of them submits this document with a covering letter, giving their own personal certification, that it is correct, there will be no objection.

MR. BIRCH: I will join in that statement.

THE WITNESS: That will save at least a day or two.

CROSS EXAMINATION

BY MR. BLENKO:

Q Mr. Danko, I would like to take you back to the beginning of your activities in connection with your Auto-Sembly development, and go through the thing historically, filling in what appeared to be some gaps or omissions.

I would like to ask you first, if it is the fact that when you began this general inquiry making your western trips and the like, it was the Signal Corps which was carrying to the electronics manufacturers the concept of making electronic gear by using preformed components with pig-tail leads which could be dropped through the holes formed in the circuit board and solder connections made at the joints, or whether that concept was something that was make known to you by those electronic manufacturers?

A Actually, it was neither, Mr. Blenko. If I can be permitted to elaborate --

Q Yes, do you want the question read to you?

A No.

I merely want to explain, because I think the question may have been based on some misunderstanding.

When we made the tour of the Midwest, we did not carry the Auto-Sembly concept with us, We were seeking information and opinions on the state of the art.

The concept of Auto-Sembly was conceived after our western trip.

Q Then the concept was yours and Mr. Abramson's, and was not the concept of any of these people that you talked to?

A That's right, sir. It was our concept.

Q And your subsequent efforts after that concept were directed toward implementing it rather than advancing work which had been done by any of these manufacturers of electronic gear or components or copper clad laminate; is that right?

A We concentrated on that concept.

Q Now, go back a little bit further.

You indicated that you were briefed on the whole subject when you got these new duties, I believe, in 1946?

A ’48, June ’48.

Q You made a complete review of the art as of that time.

Isn’t it the fact that the Signal Corps was greatly concerned about the limitations of mass production of electronic gear by point to point wiring in the event of another national emergency?

A We were so.

Q I believe it had even been estimated that if all of the available woman power in America could be turned loose on the job it would be utterly impossible for them to supply the required work necessary for assembling by point by point wiring on the scale that would be necessary in the event of a future conflict. Is that in accordance with your understanding?

A I have never conducted such a calculation, sir. I think it is conjectural, and it is possible. It doesn’t seem unreasonable considering the relative important part that electronics today play in our military capabilities. I am inclined to agree that if the situation actually came down -- came to a showdown, that electronics would be an extremely -- I am hunting for words here -- would be a mass used tool in our defensive and offensive capabilities.

I have heard projections made by high level Signal Corps people that in the event of an all out national emer-

gency that a ten-fold increase of our current expenditures in electronics would not be unreasonable. That is at a time when our expenditures all told in the electronics business amount to about $6,000,000,000 a year, so that in an all out effort it is conceivable that as much as $60,000,000,000 of electronics, as a whole, could conceivably exist as a military market in the event of an all out serious national emergency. Which would tend to suggest the rather important part that electronics play in our military posture.

And, secondly, points up as you apparently are indicating, the tremendous volume aspect of military electronics in preparing ourselves for any such contingency.

Q And the impossibility, necessarily, of fulfilling that in any reasonable time by point to point wiring?

A Well, certainly that is a rather important factor. More so, perhaps, I think, than we have stressed continually the fact that we don’t have the skills available in the event of such a national emergency to do the things that we want to do. Labor we may have, but trained labor is something else.

As a matter of fact, the rather facetious observation is sometimes made that if we were to finally reduce everything to a point where we would merely need labor to put these things together, that certain countries of this world who have very adequate supplies of manpower, and assuming that elec-

tronics was the difference between survival and non-survival, that we would be in a very bad position.

Q I wasn't reflecting on the ability of woman power, but it is a fact that a significant amount of training is involved --

A Yes.

Q -- in training people to do point to point wiring. Is that so?

A It is very true.

Q I take it that you have learned in your examination of the Bureau of Standards' smorgasbords, about the Centralab technique?

A Yes.

Q Were you satisfied with any of the techniques that have been discussed by the Bureau of Standards?

A Well, the Centralab technique, please believe me, I do not intend to disparage, I merely said it was limited in its application.

Q That is correct.

A As a matter of fact, it is very difficult sometimes to argue with success. Centralab has made as of today about 120 million of these circuits and you can't disparage anybody who has made and sold that many. It has a market and it is useful.

Q I am not seeking to disparage for a minute --

A No, I said I might have, you might have construed that I had.

Q No, I am simply trying to get this thing in its true perspective.

Let me put it to you in these terms.

When you entered on to your specific work on this project in 1948, and you did make a review of all of the material then available to you, it was in recognition of the fact that a problem still existed, was it not?

A Yes.

Q To put it in other terms, you did not in your review of that extensive documentation point to any item in it and say, "That gives us what we wish."

A We were not satisfied completely with any one of those techniques. We felt we had to do something further, above and beyond what was then available.

Q Now, even before the Kenyon reports, had the Signal Corps issued any, or published or prepared any information bulletins relating to this general subject?

A Before the issuance of the Kenyon reports?

Q Yes, sir?

A I think the first reports came out in the fall of 1947, so it would have been --

Q I am thinking of Information Bulletin No. 19. Was there such a bulletin?

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A I don't recall -- I don't know the substance of Bulletin 19. I will have to have my memory refreshed.

Q I will see if I can do that for you, sir.

A I am sure this was before my time as project engineer.

Q I have a document, nectographed, the date of which appears to be 21 March, 1947, but unfortunately it first appeared to have been written as '46, and then struck over. Can you, by reference to your notes, go back to that?

A No. I was thinking that in July, 1948, No. 68 was issued.

Q Have you looked at it?

A I can't answer you specifically with regard to the date. Perhaps if I can identify the project engineer --

(Examines document)

-- I am sorry, I can't identify the date. I could possibly, if you wish, check back our official tabular list of information bulletins and get the proper date.

Q Would you be good enough to do that?

A Certainly.

Q Do you have any independent recollection of having reviewed this document at the time that you entered into your studies?

A I am sure we did. I see things now that begin to gel in my mind.

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Q In short, you have no doubt about the authenticity of the document, but you are still not clear about the date?

A That is right. And I am not the author of this document.

MR. BLENKO: I will offer the document in evidence.

THE CLERK: No objection?

MR. BIRCH: No objection.

THE CLERK: Plaintiffs' Exhibit No. 438.

(Thereupon, information bulletin No. 19 was marked Plaintiffs' Exhibit No. 438.)

BY MR. BLENKO:

Q A word about the Kenyon reports. You have testified that you received those generally in a reasonable time after their filing. Of course, you have in mind the date when you commenced, but you had these reports periodically as a matter of routine, did you?

A Yes.

Q Have you re-examined these reports before coming here?

A Several months ago.

Q Mr. Tuttle has already testified, and we have the benefits of his discussion regarding it, so I will do no more that ask you this:

It appears from the second report, which would be Defendant's Exhibit 411 -- or is it all 410?

MR. BIRCH: It is all 410.

BY MR. BLENKO:

Q The second report in Defendant's Exhibit 410, that as of the date of that report, which is 15 December, 1947, development work with a metallic foil cemented to a plastic base had been "temporarily abandoned"?

A Yes.

Q It is not your recollection that the abandonment was not merely temporary but was complete?

A If you will give me a moment to check my notes.

Q Certainly. Feel free to refresh your recollection or refer to any documents on the date December 15, 1947, Mr. Danko.

MR. BIRCH: I have an extra copy here that you can have. (Hands document to the witness.)

A Well, frankly, I can't answer you just by memory. I would think that the subsequent reports would indicate whether he reinstituted work on the foil technique.

Q Well, they do, Mr. Danko, and the real purpose of my inquiry was to find whether you were testifying to any knowledge of any activities at the Kenyon Instrument Company beyond what is state in these reports?

A For reports 1, 2, and 3, these reports were being conducted by another project engineer. I was merely receiving the reports while I was in a test function, and I, according-

ly, must rely only on what is in the written material and in the notebook which I subsequently received in July of -- In June of 1948.

In other words, I did not visit Kenyon at any time prior to July of 1948. I wasn't project engineer until June. This material was written prior to my coming with the show, so to speak.

Q Now, you told us about a gelati silver halide process.

A Yes.

Q Isn't it a fact that the process which Mr. Tuttle settled on, and really pushed, was the gelati silver halide process?

A He did, under our prodding so to speak.

Q You prodded him in that direction rather that in the direction of etched foil?

A Yes, because he was most enthusiastic about that particular technique, since it was highly involved photographic technique, and he did have an excellent competence in photography and he had a lot of faith in the photographic technique.

Q Briefly, did not that process come to this:

That it wasn't an etching process at all, but was a process wherein an emulsion of silver halide was contained in gelatin, was placed over a base, and then photographed, just like in ordinary photography, and developed. And that

subsequent to the development this complex of gelatin and silver was reduced to a continuous menstruum of silver by the addition of heat, by the application of heat?

A I am not so sure that the process you described is the gelati silver halide process. It may be, sir, and I may be wrong. But, as I recall the process involved -- first, to answer the first part of your question, it wasn't an etching process.

And, secondly, the process, as I recall now, involved making a stencil, using an emulation, and this stencil then by spraying a conductive silver filled holes on this stencil, which was, incidentally, on a temporary base, and then a transfer operation of this sprayed silver on to a permanent insulating base effected fabrication of the final conductive pattern.

I don't know if it is particularly pertinent as to which -- whether what you have described is the gelati silver halide process.

Q Well, that suffices for my purpose.

A But, it wasn't an etching operation.

Q Do these numbers, like bulletin No. 68, mean that it was the 68th bulletin relating to printed circuit techniques?

A No, sir. This is a heterogeneous compilation of information which we thought were of interest throughout the laboratory. So, No.1 might have been on relays, No. 2 on

resistors, and so on.

Q Was there an engineering requirement sheet No. 22 issued?

A No. 22?

Q Yes.

A Engineering requirement sheets were sheets which were the technical basis for a contractor's performance. Namely, it was the documentary end of what the contractor should strive for.

The No. 22 doesn't strike me as being anything from the laboratories. Numbers that we generally dealt with were in the thousands, but, once again, I may be wrong.

Q If I understood you correctly, it was not until sometime in 1949 that you were personally made aware of patent 960, Eisler?

A In 1949.

Q And this was following a conference which you had had with Mr. Enslein of Stromberg-Carlson.

THE COURT: Telegram, September 29th.

A I didn't say that was the first time I heard of that patent, I merely said that was when Enslen brought it to our attention in connection with some information I

attempted in the previous letter, namely describing the Signal Corps offset press technique. And he sent a telegram back immediately saying apparently "You should consult Eisler's patent."

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Q I think the question was in this form on your direct examination:
"When did you first have in your possession a copy of the patent 960?"

A That was several days, possibly weeks after we had received Enslein's telegram.

Q But, isn't it a fact that prior to that time the issuance of the patent had been called to your attention?

A Yes.

Q Had it been called to your attention shortly after its issuance, or promptly after its issuance?

A No, I think mention was made of it in the notes that we received from Mr. Killen in January of 1949. Not only did he refer to Dr. Eisler's work, but I do believe that he made reference to patents relating to those, whether they were in process, or whether they were issued already, I don't recall.

Q Will you identify Mr. Killen for me, please?

A Mr. Killen is an employee of the Sprague Electric Company, Adams, Massachusetts, and he maintained liaison with the laboratory.

Q Did the Sprague Electric Company have a London representative at that time?

A I don't know, sir.

Q Was Mr. Killen your liaison man as between Sprague

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and yourself?

A Yes, sir.

Q I mean, he was a Sprague employee, I take it?

A Yes, he was a Sprague employee who occasionally visited the laboratory to keep their product in front of us.

Q Well, was the Sprague liaison a matter of continuing contact for information purposes, or was it in reference to some specific manufacturing process?

A No, it was a professional liaison. We maintained contact with many laboratories that had research and development activities, we exchanged information, we lived in a communication of exchanges, let us say.

Q It is your recollection that Mr. Killen was the first to communicate to you the word that Henderson & Spalding were doing this work?

A It was the first time I had heard of Henderson - Spalding.
I must qualify that, if I may, sir.

Q Pray do.

A I think a few days before that, before receiving Mr. Killen's letter, we did receive a British report, TR-2117, in the laboratories.

At the time I spoke to you about a year ago, I could not recall when we received the report. I subsequently did exhume our files from the vault, about a quarter of a

mile away from us --

Q Underground, or outside?

A Well, it is underground, actually, it is below the level of the ground, and we did find this letter of -- from the British liaison office, which was dated by the laboratories as being received on 10 January, 1949.

And, allowing for the two or three days for it to reach me, I would have assumed then, that we got it on or about the 13th of January.

Q The report says --

A And --

Q Excuse me.

Continue.

A I was just going to say that in that report I have the recollection of the Henderson-Spalding work being discussed. I have very little other recollection of that report. I have made an effort to locate it, but I have not been able to.

Q The report, as you doubtless know, was published in September of 1948.

A No, I don't, sir. I don't recall the date.

Q Isn't it a fact that there was a routine communication of TRE reports to the Signal Corps?

A Yes, we were getting them on an established routine of some sort.

Q One reason for my curiosity about the gap in dates is that you seemingly got the report No. 36 in a reasonably short time.

A Well, it was between June to use your date, and I believe it was September or so, there is a gap of about three months. And there are vague losses on transmission.

Q I know there are.

A I can't account for it.

Q While we are still dealing with these reports, I would refer you back to information bulletin No. 68 which you discussed on your direct examination. It is dated 1 July, 1948.

Am I correct in my understanding that the only reference in this bulletin to the use of foil is in connection with the Franklin air loop antenna?

A I don't recall.

If I may examine?

Q Surely.

(Hands document to witness.)

A I may be able to answer your question.

(Examines document.)

Well, it is in an adjacent column, merely to photographic resist, reference in the second column is on metallic conductors protected by photoresist during acid etching.

Now, if that is the reference to foil that you make --

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Q No (indicating). There is reference to stamped out circuits, is there not?

2980

A Yes, mechanically formed stencils, dies and molds.

Q You were there referring, among other things, to the Franklin air loop scheme, were you not?

A Yes.

Q And that is the only reference?

A Here it is, dies used for stamping foils.

Q That is item C on page 5, correct?

A Yes, item C, page 5.

Q Did the Signal Corps receive from Sprague Electric a sample of a T.V. coil made for RCA?

A I don't recall receiving it from Sprague, but I do think there was a coil enclosed in a letter from Technograph from England.

They had sent us a number of samples in connection with one of their letters, and one of their enclosures was an embossed coil pattern.

I don't recall receiving a flat coil from Sprague.

THE COURT: An embossed means mechanically stamped?

THE WITNESS: Apparently a die was used to shape the foil, after I presume it had been etched so that it had a convex contour to it.

This was done to enhance its electrical properties to increase its Q, as we say.

Q While we are looking for an exhibit, I will call your attention to the fifth quarterly report of Kenyon, dated

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September 15th, 1948.

I note that in the introduction on the first page of the text, there is a statement of the problems, number one of which is the development of a repetitive technique for printing resistors in a manner applicable to the already perfected methods of producing conductive patterns.

The statement below, that problem number one, has occupied the attention of the group during the quarter.

"It will be evident throughout the report that we do not have cause for high optimism over our ability to fit our own techniques to the production of circuits completely as to conductive and resistive patterns."

Do you recall that?

A Yes.

Q Please refer to Plaintiff's Exhibit 48, which is now in evidence.

This is a letter to Colonel Adams of Sprague Electric Company, from Mr. Holman of Henderson and Spalding, dated 20 November, 1948, and attached are several sheets of notes. Are these the notes that you were unable to find recently?

A These are the notes that we sent back to Mr. Killan in October of 1949, on his specific request.

Q There is no doubt about the fact, however, that you

did receive the note?

A Oh, yes, we did receive those notes.

MR. BIRCH: If I inadvertently said November, I will be the first to wish to correct it. It is 20 December.

Thank you.

BY MR. BLENKO:

Q On February 14th, 1949, in the same exhibit, Plaintiffs' Exhibit 48, is a letter from Colonel Adams to Major Holman, stating, "we duly received the samples a short time ago, and he turned the matter over to the engineer concerned."

Would that be an engineer in the Signal Corps?

A I have no idea. This is a private communication.

Q Do you have any recollection of having received the samples?

A As I said before, we did receive in one of the subsequent letters from England a specimen of an embossed coil, embossed on a thermoplastic.

That specimen is still in the Signal Corps' correspondence files.

It is part of a letter dated, I recall, that summer, sometime that summer or the fall of 1949.

Q Was there any directive or suggestion of any

sort issued to Balco and Herlec during the course of their contract work to the effect that they should switch away from the procedures that they had been investigating and turn their attention to etched foil techniques?

A That is possible. We would be so conditioned to tell them that, looking back, and I don't doubt that we may have.

They finally did use the foil technique in preparing their final samples for delivery.

I don't know whether they actually etched. I kind of recall they preferred to cut out the patterns with a sharp tool, and simulated etchings.

Q I show you a report of Herlec Corporation, the third quarterly report dated July 15th, 1949, and I call your attention to page six, where after a description of the preceding work, it says, "in addition work has been done on a DC amplifier and tone

control circuit, using a different support base material other than steatite and a copper foil material as a substitute for fired-on silver."

Is it not the fact that Herlec made that shift, if I may put it so, responsive to suggestions from your group in the Signal Corps?

A It is quite probable. This was after the date of the RCA visit, and there were no restrictions put on us by RCA or Synthane, with regard to letting it be known that much

a material was available.

Q Similarly, did Balco make a departure from silver printing to the use of an etched foil technique in this connection?

I call your attention to a Balco report for the period 1 July, 1949, to 1 October, 1949, and particularly page six thereof.

A I think so.

We, as I said earlier, concentrated on the etched foil technique, when we realized that a commercially available copper clad laminate with excellent potential was available.

It was only proper that we direct our two contractors to this knowledge, and I am sure that these two instances that you point out were the result of the Signal Corps' --

Q Guidance?

A Suggestion, yes.

MR. BLENKO: I offer the Herlec Report in evidence.

THE CLERK: Plaintiffs' Exhibit No. 439.

(Thereupon, the Third Quarterly Herlec Report was marked Plaintiffs' Exhibit No, 439.)

MR. BLENKO: I offer the Balco Report in evidence.

MR. BIRCH: No objection to either.

Is it possible to introduce the entire Balco-Herlec Reports, Mr. Blenko?

MR. BLENKO: That is all I have.

THE CLERK: Plaintiffs' Exhibit No, 440.

(Thereupon, the Balco Quarterly Report was marked as Plaintiffs' Exhibit No. 440.)

BY MR. BLENKO:

Q When you went into Belmont, on your Midwest trip, did you talk to any particular person there that you recall?

A Yes, and it is a matter of record in our survey report, which unfortunately I do not have with me, but which I can get.

I can identify the specific individual.

Q Can you tell us whether they told you anything about a Belmont Boulevard Receiver, made by printed circuits for them in England?

A I don't recall them associating any equipment with printed circuitry, sir. Belmont, as I recall, indicated no current interest in those techniques.

The name Boulevarde, I think it was, or Boulevard Receiver does strike a familiar tone. But I don't recall associating that with printed circuitry.

Q Then I take it you are unable to answer with any definiteness absent your trip report?

A Yes.

Q And that trip report is available?

A Yes.

Q Will you be good enough to supply us with a copy?

A Yes.

Excuse me, I said yes too quickly. May I supply you with an extract relating to the Belmont portion of that thing?

Q Surely.

That is all I wanted. Will you do so?

A All right.

Q Thank you.

A Once again, Mr. Blenko, without certification?

Q Surely. The same principle I stated a while ago.

Am I correct in my understanding that the 102 report was your first extensive and comprehensive report on Auto-Sembly?

A Yes, it is the white paper, if I may call it that.

Q It mentions Henderson and Spalding, or the Henderson and Spalding process, does it not?

A Yes.

Q And it does that in the context that this is one of the processes which satisfies most of your requirements, and that this particular one is one of which involves live metal patterns of LTS plastics?

A Within the context of the other limitations or

criteria that we spell out in there, namely that these shall not be thermoplastic bases, so where Henderson and Spalding made prepared circuits, on rigid thermosetting bases, they were acceptable.

Q Then you knew that they were supplying or were prepared to supply and had taught the idea of bonding foil to a rigid thermosetting base?

A Yes.

I am well aware of that.

That is the reason that they were included.

Q Would you please refer now to that Signal Corps' letter to Mr. Enslein dated 11 October, 1949, contained in Defendant's Exhibit No. 461, which seemingly was written following the Enslein telegram to which you have referred, the telegram reading

"Patent 2,441,960 Eisler covers printing of resists before etching, for manufacturing conductors."

Your reply starts off, "review of U.S. Patent 2,441,960 Eisler indicates a very comprehensive coverage of the etching and other approaches, as was believed to be the case during the recent discussions at your plant."

Does that refresh your recollection as to whether or not the patent was discussed?

A It was apparently between the time that I received here, and the time of the date of this letter. It suggests that we did have a meeting in the interim.

Q Can you identify for me the various chain of initials appearing in the upper right-hand corner of the letter of 11 October, 1949?

A The initials B.V. Mc. Is the stenographer, Barbara McNeery.

S.D. is myself, Danko.

M.A. is Moe Abramson, and R.B. is Rodger Bowen.

Q Was this letter written after consultation with your patent people?

A I would think not.

Q I note that the paragraph closes with some comment about etched products, and the statement, "in any case, the Signal Corps[10] feels that this source of patterns may be free of the entanglements which exist because of the Eisler patents."

Had you compared the Glass Products scheme with the Eisler patent?

A No, I knew nothing about the Glass Products scheme.

Q Who was the author of the sentence that I have just read?

A I am. I was expressing the probability, because Mr. Pritikin said that his process was not on the books. There was no patent back up on his process. He wouldn't identify it and that was merely raising the possibility that his process may be free of such entanglements, since Mr. Enslein was bringing up problems of patent interference, or whatever the

phraseology is that you use.

You must recall, too, Mr. Blenko, that this correspondence was generated because the Signal Corps thought it had a novel ideal in deposition of resists by the off-set press.

Our prime subject of discussion over here is this novel resist techniques, and he was drawing my attention to the fact that Eisler apparently had covered this technique within the broad aspects of his patent, and we were essentially on an engineer to engineer basis, consenting that it did seem to be very comprehensive.

Q Did you follow up the Stromberg-Carlson letter with like letters to other people with whom you dealt?

A No, no.

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[10] Etched Products?

The only one would be Beck's, which I see you have there, and that was prompted by Mr. Beck's letter, preceding the reply. There is a letter, if you want the date, I can give it to you.

Q Is that the letter that was supplied?

A It is the letter of 12 November, 1949, in which Mr. Beck cites our Bulletin No. 102 as an item for his attorney's interest, and he asked for additional copies, and subsequently we gave him the copies, and possibly this letter of 1 December
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Q That is so. That appears in the first paragraph.

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A Yes. And the reason for the rather voluminous nature of the letter is that we began to sense some disturbance on the part of Mr. Beck, that we had given away his proprietary information, which he had furnished to us 11 months ago.

This was to assure him that our source of published information which he supplied us in February, but that there was an existing patent, the Eisler patent.

I don't know whether we made reference to RCA in some fashion in there.

Q Did you subsequently call attention of Sperry Gyroscope Company to the Patent?

A Possibly. There was no reason why we shouldn't, if they asked.

Q I call your attention to a letter dated 19 July, 1950, contained in Defendant's Exhibit No. 461, and ask you if you can recognize it as a letter.

A Yes.

Q Of yours?

A Yes. It looks like me again helping spread the name of Henderson and Spalding around.

Q Apparently there was a request by Sperry Gyroscope regarding the Henderson and Spalding patent, is that right?

Is the next paragraph a correct one?

"There is no agreement as to whether the process

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sponsored by this office falls within the jurisdiction of this patent. Each manufacturer forms his own opinion of the relation between the above mentioned patent and the Auto-Sembly process."

In short, you are not taking sides; is that right?

A We were referring again to the off-set technique. We kept calling that the Signal Corps process. Sometimes we called it the Auto-Sembly process. But we were referring to the off-set resist technique.

We thought it was a novelty when Mr. Abramson thought of it, and subsequently we were advised by our patent attorney that it would not be processed as a claim

Q And you were not taking any position for or against your suppliers, as regards infringement; isn't that right?

A Yes.

As a matter of fact, please be assured that our relations with Henderson and Spalding, Mr. Shortt and others, had always been on a very pleasant and professional level.

We had never at any time felt there was any need for taking a position against Technograph.

There may have been times when Mr. Shortt pressed very hard and diligently, I might add, as to the background history of our knowledge of printed circuitry, and in accord with existing directives, whenever a question on patents comes in, that may involve us, such as Mr. Shortt's continuous

inquiries, we were, by directive, required to refer such questions to the patent advisor.

I think I have told him at least a dozen times, and he may have been irked a little bit.

Q I have no concern on that score at all, Mr. Danko. I merely want to get the fact that I think that I have already elicited.

Let me ask you this question:

There has never been any discussion on the part of you and your associates in the Signal Corps that your work antedates Eisler, is there?

A I would leave that to other people to decide, sir.

I certainly value the effort that goes into the conception of an idea, the tremendous effort that follows in reducing it to a patent, and I do think that credit should be where it belongs. I have no position in this thing whatsoever. I am a customer, in other words.

THE COURT: We will have to suspend at this time. I am sorry.

MR. BLENKO: I am sorry too, Your Honor.

(Off the record discussion)

THE COURT: I will be very glad to put this on the record: I am quite appreciative of the effort you must have put into the preparation of this matter. It has very materially assisted in the presentation of it.

THE WITNESS: Thank you.

(Thereupon, at 4:02 o'clock p.m., the hearing was adjourned until tomorrow morning, Wednesday, November 22, 1961 at 10 o'clock a.m.)
