Robert A. Boyer Oral History

Interview number: 91.1.1673.76

Reminiscences and Interview Recorded: 7 February 1985

Part of the Edsel B. Ford Design History Center Oral History Project

Transcript digitized by staff of Benson Ford Research Center: 2023

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Note to Readers

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This copy was produced from a bound, hard copy final version of the interview.

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AUTOMOTIVE DESIGN
ORAL HISTORY PROJECT

BOYER, ROBERT A.

1986

EDSEL B. FORD DESIGN HISTORY CENTER

Henry Ford Museum &
Greenfield Village

This is David Crippen of the Henry Ford Museum's Edsel Ford Design History Center with an interview with Robert Allan Boyer who was Henry Ford I's soybean and plastics expert in the 1930's and early '40's. We're talking to Mr. Boyer today in his home in Dunedin, Florida, and today is the 7th of February, 1985. We are going to let Mr. Boyer -- or Bob as he's universally known to his many friends and admirers -- tell his story in his own narrative.

A My first recollection of Henry Ford or the Ford Motor Company occurred when I was a grade school boy living in Royal Oak, Michigan. At the time, my father worked in the accounting department of the Ford Motor Company at Highland Park [Michigan]. When I reached the 7th grade, my father had been transferred from the Highland Park plant to the Henry Ford Hospital to head up the business department of the hospital.

Q This was in Detroit.

A This was in Detroit, and at the end of about a year, Henry Ford was in the middle of purchasing the Wayside Inn in South Sudbury, Massachusetts, which is the oldest hotel in America, and he sent my father out there to manage it, and this occurred in 1924.

Q How did he happen to pick your father?

A I really don't know. I never did know how or why because he had no hotel experience or anything like that.

Q Had he had contact with Mr. Ford in his work at Ford and Henry Ford Hospital?

A No, but I do remember that he had been sent out on several special projects, such as going down into a coal mine in Kentucky that Ford had bought. My father went down to set up the records and get the thing

organized according to Ford standards, and, apparently, he did a good job. He had a few other projects so that when Ford wanted a man to send down to the Wayside Inn, apparently, my father's name came to his attention. My father went out ahead of the family to get things organized, and we were to follow later on. And it fell to me to go out to Mr. Ford's offices in the Dearborn, Michigan -- the old tractor building plant was still there.

Q On Oakwood [Boulevard]?

A Yeah. Before the Engineering Laboratory was built -- just before that. I went out there one day after school, my being just probably only twelve or so. It was a big adventure for me to go out there on street cars. I went out to pick up the train tickets for the rest of the family to out to Boston, and it was there that I first met Mr. Frank Campsall -- Mr. Ford's secretary. I got to know Mr. Campsall, and he sat with me, and we had quite a talk. I'd never been out of Detroit or Royal Oak, so this was our first trip away from Detroit, and I'll never forget that train ride. I woke up the next morning, and here was a big mountain. The train was in the Berkshire Hills at the time, and those mountains looked tremendous to me.

Q What was your impression of Frank Campsall?

A Oh, he was a great guy. I really liked him. He was easygoing, but all I could say is very nice. He really looked after the Wayside Inn for Mr. Ford -- a lot of the detail work. And, he might have been the one responsible for selecting my father. I don't know. It's possible. The train ride was a big thrill for my mother and sisters and myself. I had four sisters. When the train arrived in Boston that next morning, we

were met at the station by a Ford driver in a big Lincoln. The first time I'd ever been inside of a Lincoln.

Q What year was this?

A Probably was 1924 -- in that area.

Q And Ford had just bought the Lincoln [company].

A Yeah, it was pretty new. It was a real thrill to have a driver in a Lincoln to meet us, and, as it turned out, for the next two or three weeks, we used this car all the time. Couldn't get over it.

Q What had your family driven while he was working for Ford?

A Model T's. I could tear down a Model T and put it back together -- not a Lincoln! Our life at at Wayside Inn was quite different than....

Q Did you live at the Inn?

A For the first two or three weeks we did. There was a house being renovated where we were going to live, and it took about a month before we moved in.

Q How far is South Sudbury from Boston?

A Twenty miles West on the old Boston Post Road. That was one day's drive from Boston to New York, and this was the first night out for travelers leaving Boston. Twenty miles is about as much as they could cover in the horse and buggy days. So, Wayside Inn became very famous and very popular.

Q And had a Longfellow association?

A That's right. That's where he wrote the Tales of the Wayside Inn.

Q Was this Mr. Ford's first venture in buying an inn to renovate or restore?

A As far as I know, yes, because he bought several later. But, the

Inn was, of course, the center of our life there, and it had to be renovated and rebuilt. There was a lot of things that had not been maintained properly, so Ford wanted everything perfect. And, one of the first big events that I recall was he wanted to give a big party for the society people of Boston.

Q Henry Ford?

A Henry Ford did. And, to do that he had to renovate the Inn, get it all first-class, make sure the ballroom's spring dance floor was working and all that. It was a real spring floor.

Q You mean, he put it in, or was it there?

A It was in, but it had to be rebuilt. It actually was on springs. But the Boston society is pretty blue blood, and....

Q Pretty hard to crack?

A Yeah. So this was a costume party, and all of the top people in Boston were invited, and they all came as far as I know.

Q Who handled this affair? Was that Frank Campsall?

A My father.

Q Your father did all the arranging, and who helped him with the Boston society list?

A Oh, I'm not sure about that. I wouldn't know. He must have had help.

Q How old were you?

A I was in the seventh grade.

Q How did the party go. Did you attend?

A I didn't attend. My mother and father did.

Q Did you sneak down from upstairs and watch?

A By that time, we were living in our other house.

Q You weren't in the Inn itself.

A This party took place about a year after he bought it. He spent that much time getting ready for it. So, it was a pretty big deal for everybody.

Q Did your mother and father tell you bit about how things went that night?

A Oh, yes. They were very pleased. Everything, apparently, went very well.

Q When you say a costume party, was it a costume dancing party?

A Yes, old-fashioned dance. Mr. Ford was always interested in the old-fashioned dances.

Q Had Mr. Lovett come in on the scene yet?

A Yes.

Q By the time of this costume party?

A Yes, he did.

Q Can you tell us a bit about Benjamin Lovett and his wife?

A They were from the Boston area, so he probably had a lot to do with the selection of the guests.

Q In terms of Mr. Lovett and Mr. Ford, how did they meet? Do you have any idea?

A No. Due to Mr. Ford's interest in old-fashioned dancing.

Q So, he must have made some inquiries and asked who's the best dancing master around the area, and somehow he must have gotten Mr. Lovett.

A Yes. I never knew the details, but I'm sure that's, in general, how it happened.

Q Mr. Lovett was in attendance at this Boston party?

A Oh, yes. He called the dances.

Q So, it was an old-fashioned dance and costume party. Costumes of what kind?

A For the way that people lived in the early days of the Inn.

Q Which would have been about a century before?

A Yeah. I'm not too clear on that. A dinner was served. Of course, the Inn had its own kitchen.

Q No alcohol was served?

A Oh, I doubt it. Although, there was, and still is, an old tap room in the Inn.

Q Really?

A Oh, yes. They used to serve ale and whatever they drank in those days. As a matter of fact, they were quite proud of a plank alongside the bar where the bartender used to throw his ice pick, and it would land in the wood, and he'd done it so many times that the plank was almost eaten through. They featured that.

Q Who did the renovation? Campsall must have directed it?

A A lot of it was done by local contractors and local people, and at one time, Ford had at least a hundred employees -- a carpenter gang and all of the trades people which were under my father. And Mr. Ford used to come out occasionally to see how things were going and to give further orders. I first met Mr. Ford shortly after this party. I went to Framingham [Massachusetts] High School, because the school in South Sudbury didn't have a high school -- just a grade school -- so Framingham turned out to be the most convenient, and I got interested, for the first

time in my life, in ice skating, and I played on a school hockey team. But every afternoon after getting home from school, I'd go back on the old mill pond in back at the Wayside Inn and skate in the Wintertime, and that's where I first met Henry Ford. One day I was skating out there, and here he comes walking up with a pair of skates under his arm, and he said, "Do you mind if I skate along with you?" I knew who he was, but I'd never met or even talked to him before, and we got acquainted, and he asked who I was, and my name, and we skated.

Q Were you a good skater?

A I was good enough. I made the hockey team.

Q Then, you were a good skater.

A Yeah. I always liked it. Of course, we didn't skate much in Detroit. But, we even played hockey together. We set up two stones for the goal posts to see if we could.... We got to know each other quite well, and I felt very comfortable with him. One day he asked me what I was going to do after I graduated from high school. I had already decided to go to Dartmouth College, and he said, "What are you going to study?" And, I said, "I don't know." He said, "Why don't you come out to Dearborn before you go to college." He said, "We'll give you some experience out there. We'll let you work in the plant and get some experience and find out what you really want to do and then go to college." One night my father came home and said, "Well, it's all settled now. You're going out to Dearborn after you graduate from high school." I still had a year to go before graduation at Framingham High School. September of 1927 is when I left Sudbury to go to Dearborn, and I never lived at home after that.

Q Never went back?

A Never lived there because I went back for visits, but I broke the tie there. As I arrived out in Dearborn, I went to Mr. Campsall's office, I was so nervous and scared. He greeted me, and we had a nice talk. He sent me down to Charlie Sorensen's office at the Rouge plant.

Q Do you remember where Mr. Sorensen's office was in those days?

A Yes, it was near the old coke oven section of the Rouge plant. It's gone now, but, in those days, that's where he had his office. And, about four or five years after that, he built a new office over in the Motor Building right outside of Gate 4. Russell Gnau, Mr. Sorensen's secretary, met me, and Sorensen was just leaving his office at the time. Halfway down the steps is where I encountered him, and Mr. Gnau introduced me. Sorensen said, "Well, you've got a wonderful opportunity here, and I hope you take advantage of it." He said, "I'll keep in touch with you," and that was it. So, then Gnau sent me over to the Ford Trade School, and I enrolled and became just another, regular Trade School student.

Q The Trade School in those days was where?

A In the top floor of the B Building -- the front end of the B Building at the Rouge plant. They had classrooms as well as machine rooms -- a lathe section and a milling machine section.

Q It occupied only the top floor?

A Yes.

Q Half of it was classrooms, and the other half were work rooms?

A Right. I don't know how many students they had, but it was very active in those days. It was a wonderful experience, except I couldn't

see how it tied in telling me what I wanted to study. But, the Trade School was very good experience for me, and the pay 20¢ an hour which is pretty good money in those days. Anyway, I had to live on it.

Q What was the curriculum?

A Mathematics in the classroom as it pertained to the various machine tools like the lathe and milling machine, the shaper. I worked on all of those machines, and, of course, I had never been in a factory before, so this was sort of frightening to me, too. It was a brand new life just like that.

Q You, obviously, saw quite a bit of the assembly line?

A I saw it, yes, but I didn't work on that. But, the thing that impressed me the most was that I worked in the power plant there. The Rouge power plant was a tremendous thing, and I operated a boiler where we were evaporating a million pounds of water an hour making steam for the turbines. To me, here I was pressing buttons, and this boiler was about six or ten stories high. It was a real thrill.

Q You mentioned the first time you saw the blast furnace was quite an experience.

A Yes. I was in a car, and we were driving by the blast furnace. All of a sudden, a big stream of molten iron came pouring out of a funnel like....

Q Was it one of those huge cupolas?

A Yeah. Actually, as it turned out, what I saw was slag. I thought it was iron at first. Slag, of course, floats on the top; iron came out the bottom, and this was the overflow slag which went into a big, one hundred ton ladle on a railroad track. I learned later that these

ladles, full of molten slag, were taken out to a field where they were dumped and cooled and later converted into cement. There was a cement plant right next door. But, all of these big sights really scared me because it was noisy and dirty and hot.

Q They are still impressive?

A Oh, yeah. We were there this summer, and the blast furnaces were still operating. The foundry, where a lot of the metal went to, was gone. While working at the Trade School, I lived in downtown Detroit at the YMCA.

Q It seems odd that you should be so far away.

A I didn't know the score at the time, but later I found out there was Western YMCA, and I moved out there which was much closer. By that time, too, I had turned eighteen, and my father had let me have a car. I had driven a Model T out at the Wayside Inn, and he had a car -- a roadster -- and he let me have that roadster. I drove it back to Detroit and lived at the Western YMCA.

Q What street was that?

A It was on Fort Street out there about six blocks West of Grand Boulevard. There was a park there, and this was a very nice, new building. It was very nice, and I enjoyed it there.

Q What kind of transportation did you take from the Eastern YMCA to Dearborn?

A Streetcars and buses.

Q It must have taken about an hour to get there?

A Oh, yeah. And we had to punch in at 7 o'clock, so I'd leave the YMCA probably at 5:30 [a.m.]. Of course in winter it was dark, and I was

homesick for awhile. But, my next contact with Mr. Ford and Mr. Campsall occurred the day before Thanksgiving in that same year -- '27. Mr. Ford had me brought out to Dearborn -- sent a car down for me at the Trade School. The thing that I remember about that was the impression it made on the instructors at the Trade School. Mr. Ford sent for one of their students. They hadn't heard of that before.

Q Had you met Fred Searle -- the director?

A I probably had met him, but I had no contact with him. Peterson was the shop superintendent, and he's the one that scheduled me for so many weeks in this department and so on. We got along very well. Anyway, I went out and met Mr. Ford again, and he said, "I'm going out to the Wayside Inn tonight, and I'll see your father, and I want to report to him on how you're doing." I said, "Everything's fine and going along well." So, he said, "Fine," and that was the last I had contact with anybody at Dearborn engineering labs until 1928.

Q About a year later?

A Yeah. Mr. Ford had been to Europe and had become very impressed with the agricultural methods that the farmers used on the Rhine River in Germany. They had terraces where they had vineyards, and he decided he wanted to do something like that in Dearborn. The only chemical operation that, apparently, that he was really interested in, as far as Ford Motor Company goes, was the plant up in Iron Mountain, Michigan, where they had a wood distillation operation going. They built the first station wagon bodies up there which were all wood, so the scrap wood and scrap lumber that came out of that operation went into this chemical plant -- called destructive distillation -- to produce charcoal and wood

alcohol and all that sort of thing. And, so, he decided he wanted to have a small model of that plant down at the Village [Greenfield Village in Dearborn]. He had already built a saw mill down there which was producing lumber for the various Village building, so he built this chemical plant right next door to it which is like the Iron Mountain plant.

Q You're talking about the very beginnings of Greenfield Village?

A Yeah, before it was dedicated. I was there on the dedication, too. The Iron Mountain plant had fabricated a quarter-size model of their commercial operation up there. It consisted of a retort and several stills, and, of course, quite a few big, copper tanks. And the scrap sawdust and wood from the sawmill there was to be treated and turned into various wood chemicals just like the Iron Mountain plant did. And when the parts started to arrive in the Village for this distillation operation, Mr. Ford sent for me. He said, "Bob, how would you like to supervise this plant we're building here?" My first year was about over, and I figured I'll be going back to Dartmouth or something soon. He said, "If you would be interested in this," he said, "stay another year or two and see how you like it." That was my introduction into chemistry, and that's where I've really been ever since.

Q You took no formal instruction in chemistry?

A No, not formal, but he provided access to the University of Michigan. We had several professors come down and give us impromptu seminars.

Q They were also tutors in a sense?

A Yeah. Especially during the Depression, the professors wanted extra income, and it worked out very well.

Q Can you locate it in the Village plan?

A It is the Soybean Lab. We didn't call it the Soybean Laboratory then. It was the chemical plant, and....

Q But, it's that same building?

A It's the same building. Five years ago, the last time I was up there, you'll notice that way up in the top of this wooden building is a 2,000 gallon copper tank. What happened was that this chemical plant was uncovered. It was just on a steel framework, and there was no building or roof around it or anything because it couldn't stand out in the open. But, Mr. Ford decided he wanted to enclose it so that we could start doing more things, especially when he came back from Europe and wanted to get going into the farm end of it, too, because he figured if we can distill wood, we can distill vegetables, too. So, we actually built this fairly crude building, but it covered up this chemical plant equipment.

Q What we now call the Soybean Plant?

A That's right.

Q So, really it housed this quarter-size chemical plant that was fabricated after Iron Mountain?

A That's the way it started.

Q It was used for wood distillation up in Iron Mountain. Did Mr. Ford have a specific purpose in mind when he asked for it to be duplicated?

A I've thought about that. As near as I can tell, he'd about decided he was going to have a laboratory operation somewhere out there, and he was just using this wood distillation as a starting point.

Q He did not tell you exactly what he had in mind?

A No. He didn't know himself -- nobody knew. This trip to Germany crystallized a lot of his thinking.

Q Which later became chemurgic impulse?

A That's right. This one 2,000 gallon tank, however, was so big when they built the building around it, they never could get it out. So, he said, "I'll tell you what we'll do. We'll put it up in the air." It took up too much space on the ground floor. So, we had a big casting made that would fit the bottom of this 2,000 gallon tank and a two foot diameter steel pipe that we brought in, and we hoisted that tank up in the air about thirty feet, and it still stands there.

As we got going in that chemical plant, we got interested in other things besides wood, and that's when he started to think about producing food cheaply, and then as the Depression gathered for us, the poor farmers were hurt very badly, and they were among his best customers for buying Fords. So, he wanted to do something for the farmer. So, that's how we developed into the chemurgic type of thinking. "Chemurgic" was coined for the scientific agricultural people at the time. In 1934, we had the National Chemurgic Conference at Dearborn Inn, and I was in charge of the program for that.

Q That's interesting. We still have the Proceedings.

A Yes. Irenee DuPont, who was very prominent in the movement, came out to attend the conference, and Mr. Ford spent a lot of time with him. Before that, the DuPonts were anathema to Henry Ford. They and the big banks. He didn't trust them.

Q They owned part of General Motors.

A Yeah. He was always dead set against those New York bankers. But,

he broke away from that, and I think he became quite friendly with Irenee DuPont.

Q So, the plant is opened?

A The plant was open. We didn't spend time on wood, really.

Q It was right in the middle of Greenfield Village?

A Right next to the saw mill.

Q Or what was to become Greenfield Village?

A Yeah, that's right. The Village had not been dedicated yet. It was dedicated on the 50th anniversary of Edison's first successful electric light bulb.

Q The incandescent light bulb.

A It was in '28 when the Village was dedicated?

Q November of 1929.

A That's right. One week before the [stock market] crash. I remember that. I was living in the Village at the time.

Q Where were you living?

A At the Sarah Jordan Boarding House. When Ford offered this opportunity to manage this chemical plant, he also, at the same time, said, "Well, why don't you live out here at the Jordan Boarding House," and so I moved out there and did.

Q Jimmy Humberstone was there.

A Yeah, he was.

Q Was he married yet in 1928?

A Yeah, he was married. He used to come over and visit me in my room, and we'd play chess together in the evenings.

Q Had his son been born yet?

A Yes.

Q A boy, Jordan?

A That's right.

Getting back to the chemical plant, Ford had become interested in farm crops and helping the farmer find new uses for his farm crops, and, so, the early purpose of our laboratory was to try to find industrial uses for farm crops. And, to that, in order to get started on that, Mr. Ford said, "What do you suppose we can do with carrots?" So....

Q He'd drop by, and you'd sit around brainstorming?

A That' right. So, the next morning I came in, and here four or five truckloads of carrots had been dumped right in front of the lab. He said, "Now, see what you can do with those." The first thing he thought of was to try to put it through the retort, you know, and destructive distill it. It soon became apparent to all of us that most of the average farm crops had too much water in them to really get any good out of them, and we couldn't find anything that was of very much value. We could always make a little bit of alcohol or acedic acid or something like that. Not a thing was economical or practical <u>until</u> we got to the soybean.

Q You'd tried how many vegetables?

A Oh, gee, everything. I remember we must have had a hundred truckloads of tomatoes one night.

Q They dumped them in front?

A Right in front.

Q What would you use? Scoops?

A What we finally did was we just squeezed them -- made tomato juice out of them. That's the only way. Of course, that was edible.

Q Quite a job scooping them up and bringing them into the distillery area?

A Yeah. We didn't have conveyors or anything. But, that was Ford's method. He often said to me, he said, "I can't look at anything smaller than an elephant."

Q That's interesting.

A Yeah, he said that.

Q He thought rather large?

A Yeah. But, he had a lot of other interesting ideas. For instance, he wanted us to record our notes every day, and he had a distant relative, a nephew named Ed Litogot who was a printer by trade.

Q One of his mother's family.

A Ed was a printer, and he was out of a job, so Mr. Ford had a printing press installed in our laboratory, and Ed Litogot got a job there, and his job was to print up our notes. Every day we had them printed and had them in book form.

Q He would set the type from your pencil notes?

A Yeah.

Q That's a big job.

A Oh, yeah. That's the way Ford operates. You can't even find that today. With the word processors, you might. But, that was his way of word processing, in effect. But, until we got to the soybean, we really didn't have anything that meant anything to anybody. It was good experience for us, and to man this laboratory, he said, "Let's get some of the best students from the Ford Trade School." He said, "Go down and pick out some that you know and look over their records, and, as we need

them, we'll bring them out here and get them in the school, and if they're interested in chemistry, fine."

Q Was chemistry part of the Trade School curriculum?

A They had a course in it, but it wasn't very major. It was just enough to know the metallurgy of iron and steel. So, as we got busy and we had to handle to more tomatoes and that sort of thing, we needed more students -- more help. And, also at the same time Ford had started a trade school out at the Wayside Inn, and we brought about twelve of those boys out. Frank Calvert was one of them. Have you ran across him?

Q No.

A Well, he was one of them. He's quite a soybean expert now, too.

Q He was a young chemistry student?

A Yup. But, at one time we had over a hundred boys working in the lab, but our basic crew was probably twelve to fifteen. But, as I say, until we got to the soybean, we really didn't have any solid progress that meant anything.

Q The soybean came up in a normal progression of going through all the vegetables that were available?

A Yeah. The soybean was practically unknown in those days.

Q In this country?

A Yeah. As I recall, there may have been 40,000 or 50,000 acres growing or maybe not even that much.

Q They were using it largely for feed?

A Yeah, feed. The oil wasn't very good. In those days we didn't know how to process the oil. It had a bad flavoring, and it would go off flavor very quickly. But the soybean had very little water. In fact,

it's 12% or less. And we knew that the protein from the soybean was similar in some ways to the protein in milk, and so that got us thinking on what will we do with the soybean protein if we wanted to, and, of course, that led to plastics and all that sort of thing.

Q Can I interrupt? I want to ask two questions. What about this, perhaps, mythic story that we've heard all these years that Mr. Ford one day discovered a book by a couple of British authors on the soybean and its possible uses?

A It's possible. I don't recall the details. It's very likely that's what happened that he read about it in some journal or book. I remember him talking to me about it. He said, "I wonder how we can get ahold of something like that?" So, we went out and got something similar, and you could buy them in a feed store or something like that.

We got to studying whatever we could find on soybeans. There was a plant in Chicago that had been built that was along the lines of a chemical plant. They were using solvents to extract the oil out of the bean. Most of the bean processing up to that time was done in presses -- very inefficient -- to squeeze out the oil, and then the cake was ground up and fed to animals. In Decatur, Illinois, which is the home of the soybean -- soybean center of the country -- there were two or three of what they called expeller plants. They had the screw press which would squeeze them under terrific pressure and get the oil.

Q The oil was thrown away, or what was it used for?

A No. For awhile it was used for soap, and they tried to make salad oil or shortening out of it, but the flavor was very bad. They could use a percentage of it in along with cottonseed oil and make a saleable pro-

duct, but it wasn't very good. Soybean oil always sold cheaper than the others.

Q The residue or the cake, as you called it, was fed to...?

A Farm animals.

Q As regular feed?

A It was their protein feed. We wanted to get the protein pure, so in the lab we developed our own process for extracting the oil.

Q This was different from the expellers?

A Oh, yeah. We used hexane solvent, like drycleaning. We'd flake the beans and run them through a pipe that was full of hexane on an angle and with a screw in it.

Q This is a solvent?

A It's distilled out of petroleum. It has a very narrow boiling range -- 66° centigrade. The Ford extractor, however, got quite a lot of attention. We built it across the street from the chemical plant. It was about 150 feet away. Mounted it all by itself because everybody was afraid of fire, and all we did was to build a roof shelter to cover the equipment but no walls because we wanted to get....

Q What year was that built?

A Probably '33, because we had a model of it at the World's Fair in New York. We made a glass model on a table and showed that at the World's Fair. But, from the oil-free flakes that emerged from this unit, we then extracted the protein from that. We developed a process for doing that, and that was about 1933.

Q How did this process work again? You took the actual bean, and then what did you do?

A We ran it through rollers, flattened them out, and made flakes, and then those flakes were fed into a bath of this hexane which was contained in our case -- a twelve inch pipe on a 30° angle and then upright at one end where the flakes dropped in until a screw picked them up and took them up, and at the top end of the pipe we had a steam jacket on it. So we boiled off the hexane, and then the flakes emerged oil free.

Q The hexane extracted the oil?

A Yeah, and the hexane was recovered. We put it through a still, and the oil came out the bottom of the still, and the hexane came over condensed and recycled.

Q You recovered the oil and you recovered the hexane as well to be used again?

A Used over and over and over. And, we actually had a working model at the Chicago's World Fair. They would never let you do that today. Too dangerous. Actually, the first big plant in this country was in Chicago, and it blew up. It destroyed a whole block of buildings and killed a lot of people. Something happened, and the vapor accumulated and sparked. I went over to see that plant to learn all we could from it. It was a setback at the time.

Q Fortunately, they didn't allow smoking out there, so that helped.

A Well, there's some anecdotes here. As I said, my first plan had no walls on it -- just a roof. We soon got too cold, so we decided to enclose it in, and here was a boiler right along side. And the safety department men from the Rouge plant came out one day. I don't know why. Somebody must have tipped them off, and they said, "Oh, we're going to have to close you down. You can't do anything." So, when Ford heard about it....

Q What would have been the possible result, and would it occur?

A Well, we could have blown that plant up.

Q How?

A Accidental spark. In those days, our light switches -- we didn't have safety-designed light switches or anything else.

Q And what would have exploded?

A The vapor. The hexane would flash off as a vapor, and then it becomes just like....

Q It wasn't always enclosed?

A Well, the vapor was supposed to be enclosed in our pipes, but they always have leaks. Anyway, when [Henry] Ford heard that they were going to close it down, he said, "You get that fellow out here tomorrow. I want to talk to him." So, this was a summons from the boss. So he was there, and he said, "Now, Bob, bring me a pail full of hexane." So, I did. I didn't know what he wanted. And he said, "I want a shovel too." And, okay, we had a shovel because this boiler that we were using, I think, we were burning coke in it -- shoveling.

Q He wanted a pail of hexane liquid?

A Hexane liquid. We brought it in by tank cars. Anyway, this safety man didn't know what was happening, and when Ford put that pail down there, and he reached into the firebox and got a shovel full of red hot coke, and the safety man turned pale. Anyway, he took this shovelful of red hot coke and plunged it into this pail of hexane. I nearly died myself. Well, he knew how to do it, and all it did was cool off the coke. Of course, some vapors came off, but....

Q How did he know what to do?

A The speed. He didn't give a chance to -- he didn't put it in slowly. He plunged in it and covered it up so air couldn't get at it. Anyway, the safety man turned around, and he never said a word, and he went back to the Rouge plant, and Ford said, "Now, don't let me hear anything like that again." But, we learned our lesson. We were very, very careful from then on.

Q Since you'd gone to Chicago, and you looked and you talked to the people there, and you knew exactly what had happened?

A Oh, yeah. We never knew where the leak was. They didn't themselves. There have been several others since then, too.

Q What safety precautions did you take?

A The last experience I had. Ralston had six plants like that, and they divided the various operations in separate buildings. The one building that had the hexane was all by itself, and they went to extreme limits to have non-sparking tools and everything like that. And, even so, they're still scared to death of it. But, they haven't had any problems with it. Some have.

Q They're still doing this same process?

A Oh, yeah.

Q This process that you developed is still a standard in the industry?

A Yeah. I won't say we developed it.

Q You adapted it?

A We developed the small plant, but they still call it the Ford Extractor, but actually it was a little too small to be economically competitive with these big plants.

Q You were doing research?

A Yeah, we did six tons a day, whereas a big plant will do 1500 tons a day. But, we did get a good quality oil, and today soybean oil is very quality. And, we used it in our salad oils. Procter and Gamble uses all kinds of it in Crisco and other products.

Q What process did you develop to get rid of the rancid properties?

A That, again, is an oxidation process, and we just took pains not to let air get at this oil or anything else.

Q You kept it sealed?

A Yeah. Now, getting the protein out without damaging it was a much bigger problem, but we did develop a process there at the Village chemical plant where we actually got pure soy protein, and then from there, we went and started making plastics out of it and, eventually, fibers and that sort of thing.

Q How did this process work?

A The flakes were fed into an alakaline water, and after about an exposure of about an hour, the protein becomes solubilized, and it goes off in the water, and by centrifuges you can take off the protein-laden water, and you get flakes, or spent meal as we call it, off the other side.

Q It was sort of a paste or...?

A Yeah, I guess you'd call it that.

Q Paste or sludge?

A It's like a sludge, whereas the protein comes off of our filters when we acidify the alkaline water. It coagulates, and it comes out just like cottage cheese. And we got into plastics and developed a fairly

good plastic out of it. They built a big department down in the Rouge plant -- in the glass plant, actually.

Q Can you give us a step-by-step [development of the plastic]?

A Yeah. Once we dried it -- this cottage cheese -- we ran it through hot air dryers, and then we ground it to a powder. Now, that powder could, just by itself, be molded into the form of, say, horn buttons or gear shift knob nuts by compression molding s -- about 2,000 pounds per square inch at about 300°. It is soft plastic, and it'll fuse together under pressure. Our problem was getting it water insoluble enough so water wouldn't affect it.

Q How did you do that?

A We found that by treating it with formaldehyde, we could get it so it was fairly inert in water but not good enough to use on the coil cover. We were trying the Ford distributor on the first V-8 engines. We used a plastic Bakelight coil in those days.

Q Bakelight was the standard plastic of that era?

A Right. It was very expensive.

Q In the 'Thirties?

A Yeah. It was pretty expensive in those days.

Q What was the makeup of Bakelight?

A Phenol formaldehyde. We found by just treating the protein with formaldehyde, we waterproofed it about 90% of the way we wanted it, but that other 10% eluded us. We never could put it on a distributor.

Q Formaldehyde was a phenol resin?

A Phenol cooked together with formaldehyde to form the Bakelight resin. So, we found that in order to get a compound that would be good

enough to put on by electric uses like the coil and the rotor and that sort of thing....

Q You had no trouble with horn buttons?

A No, because we didn't care if they leaked. But we found that by taking phenol formaldehyde and putting a small percentage of that into the protein, we could get waterproof stuff.

Q To be used for...?

A On the dielectric system of the car. And we had a fairly big department going on that down in the Rouge plant.

Q This is mid-'35?

A Yeah.

Q And, you had outgrown your original research area in Greenfield Village?

A No, no. We stayed there. It was our headquarters.

Q You are still there, but you were working on....

A The division down in the Rouge plant.

Q Did he build you a separate plant at the Rouge?

A No. Part of the old glass plant was idle, and we decided to put the plastic operation there, and then one thing led to another, and he decided -- or it was decided -- we needed more oil for the Rouge plant. Incidentally, one of the other big uses for soy oil turned out to be foundry core binders to make a foundry casting of a V-8 engine block. We used to use several tank cars a day down in the Rouge plant.

Q You had become commercial?

A Yeah. We didn't have enough soybean oil to satisfy them. Right next to the glass plant, then, there was an empty, so Ford said, "Well,

let's build a plant there." So, we built a large extractor there -- fifty ton a day or something like that.

Q You had a very fancy store front.

A That was the next plant. He still built a wooden building right in the middle of the Rouge plant. It didn't fit in with anything. But, we got it going, and....

Q You had space originally in the glass plant, and then you built a wooden plant...?

A Right next to it. And, we used the silos in the glass plant as storage for the beans, and then we blew them over. We blew them instead of screw them over, and that worked out all right.

Q What do you mean by that?

A Oh, we have an air system, just like--we had a pipe that can suck the beans right out of this hopper.

Q Out of the silo?

A Yeah, and we blew them over to a collecting bin in the soybean plant just as much as we needed. We didn't store many over there. Then, shortly after that, it became apparent they needed more oil, and we thought we were going to need more protein for plastics, but it turned out we didn't. The old bunker building of the old coke ovens down on Miller Road were not in use, so [Henry] Ford said, "Well, let's build the soybean plant there," and that's the building that you saw this big sign on. Right on Miller Road there, and it was very prominent.

Q Was it neon? Did it light up at night?

A I think it did. And, that was the biggest plant we'd ever built, and when I left, it was still running.

Q When you said bunker, what does that mean?

A That's what they used to call it for handling coal.

Q So, now you've got three plants, in effect.

A Well, they had to tear the other one down -- the wooden building in the Rouge plant -- because they needed the ground for something else, and that's when they moved over on the one on Miller Road. And there was a pretty tall smokestack that had been servicing the coke ovens, and they tore the coke oven out and left the stacks standing. So, Ford said, "We'll make our own power here and use that stack." But the stack was way too big for our little dinky boiler, and vapors from the fire would go and get half way up the stack, and then they would condense and then freeze, and the first thing we knew, the whole thing was going to collapse.

Q Why?

A The vapor from our -- we were burning coke then, and there's a lot of water vapor in stack gases. And on a cold day, it would only get about half way up this big stack and then condense inside, and we found that the bricks were flicking off and dropping down, and we soon had to stop that.

Q Was this one of the main power plant stacks?

A No. It was a coke oven stack, but it was not far from the main power house.

Q What did you do?

A We just put in our standard stack at the proper size -- or pipe. Because they had to tear the old brick stack down because it was unsafe. You could see we were getting into bigger operations, and the....

Q More complex?

A More complex and more sophisticated. Our work on the soy protein, as we got into that investigation, we found that we needed very accurate control of temperatures and PH's, which is alkaline and acidity, and it was obvious that we didn't have enough room in the chemical plant to do what we really wanted to do. So, Mr. Ford had a building across from the airport on Oakwood Boulevard [in Dearborn]. The building became empty there, and he said, "Well, let's fix that up and put our protein work over there." He said, "We can air condition that, and we've got plenty of floor space to put in our protein plant, and then later on if we are going to make woolen fabrics out of the soy, we can put in a weaving miller," which is what we did. It was probably the first air-conditioned manufacturing space that Ford ever built.

Q Why was it air conditioned?

A Because our protein was so heat sensitive, and we wanted everything just right, and he didn't care what it cost.

Q You were taking the protein and fashioning it into thread or fiber?

A Fiber. Spinning it like you spin rayon, and....

Q Had that been done before?

A It had been done with milk protein in Italy, and when we heard about that, we immediately decided let's see if we can do it with soy, and it looked like we could, and we did. We spun the fibers at that 1938 World's Fair in New York. We had a spinning unit in operation there because it was an interesting operation to see.

Q In the Ford exhibit at the 1939-40 World's Fair in Flushing Meadow.

A Yeah. We had quite a few patents based on that.

Q As this process took form, how did you and Mr. Ford envision that it would be used for -- these soy fibers?

A The Ford car -- even the cheapest one -- had to use expensive mohair on the side walls of the car. You couldn't use cotton thread which is much cheaper.

Q What was mohair?

A Mohair comes from a special goat. It's an animal protein fiber. Wool is too, but mohair is stiffer. In order to keep the side wall upholstery from marking is what we called it. Every time you brush a cotton, you'd leave marks. So, they were forced to use expensive mohair for the car, and they used something like $7 a car.

Q Did all automobiles in the United States use mohair?

A Yes. This was before nylon really got going. This is what we were shooting for was to replace mohair and, eventually, wool. This manufacturing space, air conditioned as it was, turned out to be our -- well, it defeated us -- because the Air Force came in right after Pearl Harbor when we were getting set for war and said, "We need this air conditioned manufacturing place to make Pratt and Whitney engine parts, which Ford had a big contract for in the Rouge plant. They built a special building and were producing Pratt and Whitney radial engines. Some of those parts had to be so accurate -- 10 thousandths of an inch -- that they had to have air conditioned space for the tooling. So they came out and took our building away from us.

Q Expand on why they took your building away.

A Because tolerances were so close on the airplane engines -- 10 thousandths of an inch was nothing -- it couldn't be warm one day and

cold the next. It had to be the same temperature all the time in order to reproduce these parts to be accurate enough.

Q In effect, they displaced you? Was this the only air conditioned building in the area? They needed the air conditioning?

A Yeah. Right now! And, besides, we were doing postwar work, which wasn't vital to the war effort.

Q This was just North of the Dearborn Inn?

A Yeah.

Q About where the present-day engineering center is on Village Road?

A That's right, that's right where it was. We had the first building there, and everything came to a head at the time. Edsel became ill.

Q I'm going to move you back to about 1938. You're making these fibers. For what reason?

A Synthetic wool.

Q Why? And, what are you doing with the synthetic wool? What are you doing with the fibers? Are you weaving it into a cloth?

A We finally installed a complete weaving plant where we took our spun fibers, cut them to the same length as wool -- about an inch -- twisted them into threads, and put them through a loom, and made cloth out of them.

Q What did you do with the cloth?

A Put it in the cars. We never quite got to that point, but that was the intent.

Q You were thinking of replacing mohair....

A And wool.

Q And wool with the synthetic soybean fiber, okay. So, you took

these fibers, and you wove it into -- from what you've shown me here -- a rather handsome piece of synthetic fiber.

A This is actually 65 percent wool, 35 percent soy.

Q This looks like it might have been used for interior automobile upholstery.

A Yes. If we'd left out that stripe, it could have been, but this was actually made as a stunt. Mr. Ford wanted a suit out of it, and I had suits made for my kids. It was a trial run at a textile plant out in the East.

Q Oh, it wasn't done in Dearborn?

A We sent them the fiber, but we bought textile equipment which we installed in this plant in the engineering setup there, and we were intending to produce stuff like that, but we got shut down.

Q But, before you did, you produced enough of it to have a test run?

A Oh, yeah. We made test runs.

Q At a textile mill in...?

A We had Cheney [Silk] Mill in Manchester, Connecticut, right outside of Hartford. A very famous silk mill. We also found that these fibers blended in very well with rabbit fur for making men's felt hats. So the Hat Corporation of American took all the fiber we could make. It wasn't very much, and they would blend it in with the rabbit fur. And they actually had them on the market.

Q It makes the...?

A The felt. But, you see, rabbit fur is very expensive and also very dirty, and people got sick.

Q What was the felt composed of before this process began?

A Mostly rabbit fur.

Q Just rabbit fur? This gave it a certain body?

A And this clean air operation. They had hoped, eventually, to get it a 100 percent.

Q Let's go back to that suit of clothes that you had made for Mr. Ford. There's been a lot written about that.

A He had his own tailor. We brought the cloth back to the tailor, and he made it up.

Q In Dearborn?

A Yes.

Q What were the percentages, again?

A This was -- as near as I can recall -- 65 wool, 35 soy.

Q That was the same composition as Mr. Ford's suit?

A Yeah.

Q Did he actually wear it?

A Oh, yeah. I had one, too.

Q Did you?

A We had overcoats for my kids.

Q Overcoats made out of the same combination?

A We made them up like camel's hair. We could dye this any color you wanted, of course.

Q You could dye it?

A It's a protein fiber. That's the difference between that and cotton or rayon which are cellulosic fibers.

Q They are dyed also?

A Oh, yeah. But, they don't have the body. They'll crease and wrinkle and that sort of thing, whereas....

Q This was wrinkle resistant?

A Yeah. Like wool, it was compatible with wool. If you'd put rayon in there with wool, it would wrinkle.

Q It made it very durable and partially wrinkle-free fabric?

A Yeah. It had what they called hand or drape -- draping ability -- which cellulosic fibers do not have, and we were just lucky that our soy protein fibers....

Q You mean it hung well like good wool?

A Right, yeah. That's exactly right.

Q What happened to Mr. Ford's soybean suit? Do you have any idea?

A No. Of course, he was having clothes made all the time, so....

Q More than one suit of this material?

A Probably. He had one style that he always liked, and I don't know whether he deviated much from that or not.

Q He had an overcoat made, possibly?

A I don't know about him. I know my kids did.

Q How about yourself?

A I didn't have a coat made. As I recall it, we only had a limited quantity of this camel's hair stuff.

Q You made other configurations besides the imitation camel's hair?

A Yes.

Q What other types of fabrics?

A We made silk ties.

Q Silk ties!

A Cheney Silk Mills was noted for their silk and, especially, their tie fabrics. So we made quite a few of those.

Q They made them up for you?

A Yeah.

Q You could dye those?

A Yes.

Q Did it lend itself well to dyeing?

A Oh, yes. That's one of the basics of protein, and it dyes easily, holds fast, and holds the color. It blends well with animal protein fibers -- that was the funny part.

Q No one had ever tried it?

A No.

Q It may have been existent in theory, but no one had done it on the scale that you were doing it?

A No. The Italian people with their casein milk protein fiber had a commercial operation. The National Dairy Company in this country put in an operation for making fibers from milk casein.

Q That's fascinating. Your kids wore soybean fiber clothes?

A I had a suit. We had a lot of hats, of course.

Q Did you make them or did the American Hat...?

A They made them. They had their own felting machines.

Q Felt was a process, not a fiber [compound]?

A That's right. It's a process.

Q I always thought that felt was the actual material that hats were made of.

A No. For hats, it's made out of rabbit fur. For pool tables, for instance, it's made out of wool.

Q The felting process, is that still being done in this country? Is it still rabbit fur?

A It is for hats, yeah. They haven't found anything since we went out of business with this. But, of course, hats went out of style.

Q They're not making as many as they used to. So, the rabbits are safe for awhile?

A Yeah.

Q So, felting was the process of pressing the...?

A They would suck the fibers in an air stream over a cone which had a screen on it and in the approximate shape of the hat -- a bowl and a brim. After they built up whatever thickness they wanted on the screen, then they would take it off and build a new one, and they had it mechanized so that the process was very fast.

Q And that process has not changed? It is still done the same way?

A As far as I know.

Q So, you've come up with a commercially-viable process. It may not be financially viable, but Mr. Ford was willing to experiment?

A Right. At the time, wool was selling for $1.10 a pound, which is expensive. This was way back.

Q This was 1939?

A Yeah. And there was several dollars worth in a standard Ford car body. So, we had a chance, we thought, of providing an economic saving there. We never got a chance to prove it.

Q What year did the government take over your plant?

A 1943. That's when I left Ford.

Q You've got three years there that you're doing a lot of this?

A Yes, but it took a lot of time. It just wasn't that easy.

Q It didn't happen over night. So, you were working out this process over a period of about three or fours years?

A Yes.

Q 1938 to 1943 -- five years?

A Of course, our problem was always to try to develop more tensile strength on the soy fiber. We could get within about 80 percent of the strength of wool, but our wet strength was always a little low. What we were spending most of our time on was trying to develop higher tensile strength -- both wet and dry.

Q All through this you had the unquestioned support of Mr. Ford. He must have been fascinated by the things you were doing there.

A He was. Oh, yeah.

Q And he must have spent an awfully lot of time with you as things became more complex -- more sophisticated. What was his reaction to the progress you were making?

A He was fascinated with it. Every morning he would be in my office there in the chemical plant. He was there sometimes before I got there.

Q In Greenfield Village?

A Many mornings I'd come in, and his car would be out in front, and he'd be there at the table. There's a picture of us at the table looking at.... From there he'd say, "What happened yesterday?" He'd follow that pretty close.

Q Would he read your printed, daily report?

A Yes. Somewhere I have a picture of him on his 75th birthday reading one of our lab report books on his knee without glasses.

Q Without glasses? That's interesting, because he always put them on to read, didn't he?

A Yeah. But, he had his photographer....

Q Ebling?

A Ebling -- George Ebling. He had him with him on his 75th birthday, and he came down to our lab, and he said, "Take a picture of me reading these notes," and he took one without his glasses.

Q Was he rather vain about that?

A Yeah, I think so.

Q There's only one or two pictures of him with his glasses on.

A That same day, as he was walking out the door, he said, "Come on, Bob, I'll race you over to the soybean plant" -- the extraction plant, which was 150 feet over.

Q The one across the way.

A He got a head start on me, and he beat me. But this was his 75th birthday! So, these are all little anecdotes.

Q Give us a picture of Mr. Ford on his 75th birthday. Was he in pretty good physical shape?

A Yup. He'd had one sickness where he was in the hospital, and I didn't see him for a month or more. They kept it very quiet. I never really knew what it was -- a hernia or something.

Q He was in Henry Ford Hospital?

A Yeah. But, other than that, as far as I know, he was always in good shape. Of course, he was quite a food fetisher. He was not a true vegetarian, but he was pretty close.

Q Tell us about adapting the soybean mash to edible foods which he was, apparently, very much interested in. And could you tell us about the famous soybean menus that were prepared.

A There were a lot of them. Have you ever read Dr. Ruddiman's reports?

Q I wanted to ask you about Edsel Ruddiman.

A He's the one that really put on those soybean dinners.

Q Edsel Ruddiman had come to work for Mr. Ford in the mid-'Twenties. They were chums at the old Scotch Settlement School -- seatmates.

A Yeah, I think they were.

Q He had gone off to get his doctorate in chemistry at Johns Hopkins, and he'd taught at Johns Hopkins.

A I never knew his history.

Q And then Mr. Ford asked him to come back to work for him in [Dearborn].

A Yeah, that's true. He set up a private laboratory for him and converted an old house there.

Q Where was that?

A From the rear of the engineering building where the service department was. Where Ray Dahlinger's office used to be.

Q You mean the Engineering Laboratory?

A Yeah. In the back of that was what they called a garage and a service department and odds and ends of things.

Q Near the radio station building which is still standing?

A Yeah. There was a house near that, and that was converted into a laboratory for Dr. Ruddiman.

Q Now that's gone?

A Probably is.

Q All that's left from back there is the old WWI radio station [which has been removed to the Village]. That's where Dr. Edsel Ruddiman had his...?

A Yeah. And even had a dining room in there so that he could serve small meals to small groups.

Q How did Mr. Ford decide that he wanted to experiment in using soybean compounds as food for humans?

A As I said, he was always interested in food, and we heard these stories that the Chinese nation lived on soy protein. That was their main source of protein. It's quite easy to grow.

And another thing that intrigued Mr. Ford was that it was a legume which means that it could use nitrogen from the air through these bacteria on the root system. Of course, nitrogen is the most expensive part of fertilizer, so you save some that way.

Q You didn't have to fertilize it much?

A Not very much, but, as it turned out, they are fertilizing a little bit. The soybean grows so well now, we're getting so many bushels per acre that we're eating up the ground, they have to replenish it. In the early days we were lucky to get 15 or 16 bushels per acre, but now they get 50 or even a 100.

Q I'm interested in the soybean menus. Wasn't there an executive dining room at the engineering laboratory?

A There was.

Q Okay. But the first menus were tried out in Dr. Ruddiman's office?

A That's where I first saw them. He and I worked together quite well, and he was more interested in the food end, and we we in the industrial end. But he and I went to the first soybean conference in Washington, D.C. together.

Q When you say the first, the first nationally-held scientific conference on the use of the soybean?

A They formed the Soybean Association of America. The father of the soybean was Bill Morse (W.J. Morse). He worked for the Department of Agriculture, and he went over to China and brought back 3,000 varieties of soybean. The Agricultural Department had an experimental farm in Holgate, Ohio, and they planted these 3,000 varieties down there. I went down to see it. They wanted it to classify the varieties for maturing dates and times. Some were frost-resistant. And they hoped to get one that would taste good, too. They never did. I went down to see that farm, but....

Q Did you and Dr. Ruddiman go down together?

A Not to that farm, but he and I went out to Washington for this first meeting. As far as I know, it was the first annual meeting.

Q And you were astounded by the apparent possibilities involving the soybean? Had Mr. Ford become interested in soybean before this conference?

A Oh, yeah. That's why we went.

Q So, you learned...?

A We saw leather-like products that the Chinese make. They make what we would call -- the skin that forms on milk when you boil it. They boil soy milk over there and got these tough skins, and they make food delicacies out of them. But they also looked like leather. We were interested in trying an industrial....

Q Did it have the consistency of leather?

A Yes. but it wasn't permanent. As long as you had water in there, it was quite good.

Q But, once it dried out, it was just...?

A Just brittle. But, this sparked our interest, and we always figured if we learn how to do it right, we can come out with a synthetic leather.

It is interesting to note, when the war hit, the first things that went on ration were protein products -- leather and wool.

Q Why?

A They are the scarcest thing we have. We can't live without them, and they immediately become scarce.

Q What about basic protein products?

A Leather and wool right away went on rationing in the war. You couldn't get a pair of shoes without....

Q Leather and wool are considered protein products?

A Yes. They're animal protein.

Q Animal protein, okay. I keep thinking the vegetable protein...?

A That was the difference. We're approaching it from the vegetable. We don't want to have to go through an animal, because the animal is too inefficient. As the population grows, we're going to be forced to eat the soybean stuff whether we like it or not.

Q The war rationed animal protein products immediately because of the potential scarcity of the animals?

A Yes, that's right. Not only that, of the products. They were expensive products to start with, because the animal is so inefficient. It takes about twenty pound of feed to go into an animal to get back one pound that's useful.

Q Get back what?

A Say you put twenty pounds of feed into a cow, and you want a pound of meat, or milk, or....

Q Whatever the product is? Edible or usable products?

A Yes. It's an inefficient process.

Q So how did you propose to...?

A We didn't know. We knew we could make leather-like products, and then we knew we could make plastic products under heat and pressure. We thought we knew we could make pretty good synthetic fibers -- wool-like fibers. These are things we were working on all the time.

Q This is very important. But I've always been fascinated by -- and I know this may seem trivial to you in retrospect -- those soybean menus, which I'm sure no one really liked.

A I didn't like them, I know.

Q So Henry Ford had Dr. Edsel Ruddiman trying to come up with an edible soybean menu, and I believe the whole meals were fashioned of this substance?

A Yes.

Q These were pretty much soybean mash that you were using as a basic substance?

A That's right.

Q And somebody, perhaps Dr. & Mrs. Ruddiman, was attempting to come up with soybean milk, right?

A Yes.

Q Soybean soup?

A Right. Croquettes are in there.

Q Croquettes. Some simulated meat products, soybean bread, soybean butter, soybean ice cream, soybean cakes, soybean salad. So you'd have

this basic, very adaptable, but unappetizing, mush that you had to simulate by shaping, or by flavoring, pretend that these were the familiar products? Dr. Ruddiman must have been very ingenious to come up with these menus or these simulated food substances?

A He was a good food chemist, I know that.

Q He would flavor them with a flavor of, say, meat?

A Yes. We could smoke them, for instance. That was the easiest way to cover up some of those objectionable tastes.

Q What was the taste that was so objectionable? Was it the rancid oil?

A Rancid oil, yes.

Q Which oxidized very quickly?

A Yes. The minute you press the bean, if you let oxygen hit it, almost within a minute, this flavor developed.

Q Would it be something that would make you nauseous?

A Oh, no. But you couldn't eat too many mouthfuls of it.

Q I'm sorry to press you on this on what seems a very trivial aspect of it, but we have these printed menus, and we have these Ford News articles that we have reprinted many times for people. Did Mr. Ford insist that some of you be guinea pigs in these soybean dinners?

A He never made me.

Q He never asked you to eat it?

A I did, though.

Q Would you go over to Ruddiman's laboratory and house?

A Yes. We finally made the milk down in our lab because we had to extract the protein, and we could make the milk there. But it still wasn't good enough. Today, we can do it.

Q Tell us about the executive dining room. Who ate there?

A Mr. Ford, and Sorensen, and Weibel, and Martin, and the top executives.

Q This was in the Engineering Laboratory?

A Yes. The corner room. It could seat twelve/fourteen people there. And he frequently had guests. He invited me in about half a dozen times, which was quite a thrill. But there was another dining room just outside of that where the sub-executives ate, like Frank Campsall and Larry Sheldrick, the chief engineer. I was in there, occasionally. I can imagine that he had the cook make some experimental dishes for them, which he'd serve, and I can just see them eating them and not liking them.

Q Even though they had flavors that suggested...?

A Yes. You know, you're going with two strikes on yourself. Nothing would taste good if you don't present it right, and knowing the fact that it was soybean, that was the kiss of death.

Q You don't think he was like a father sitting there watching his children eat and saying, "You'd better clean your plate?"

A No, I can't quite see that.

Q Was he sort of pixyish about this?

A He frequently enjoyed teasing them.

Q Would he eat it himself?

A Yeah, I guess so. I can't honestly say I ever saw him eat any of it, but he must have.

Q But he expected his executives to eat it, at least taste it?

A Yes.

Q How did the soybean ice cream turn out?

A You put enough vanilla and sugar it, and it's mostly water, too.

Q How did you overcome that terrible deficiency?

A It's controlling this oxidation. If you grind the beans under water, for instance, then there's no problem.

Q Of course, it's expensive?

A Yeah. And sloppy. We do know how to use, which we call, reducing chemicals that prevent the oxidation reaction.

Q The process has evolved since then?

A And we know now that it's the enzymes that are doing it, and we know now how to control enzymes much better than we did in those days. We can inactivate enzymes several different ways now. That's the key to the whole thing.

Q You knew they were there, but you didn't know how to utilize them?

A We didn't know they were causing this either.

Q How do they cause it?

A On this particular one, lyproxidase is the culprit, in this case, in the bean. That's present in the bean. If we boil the beans or heat them, we can inactivate the enzyme, but we also insolubilize the protein. We ruin the protein when you get too much heat, so you've got a fine point in there.

Q A delicate balance?

A Very much.

Q So you developed, by trial and error, a process that would take the rancidity out of the bean? It could be fairly edible then?

A Yes. There's quite a strong movement today in this country on tofu. Most of it still has got a rancid taste.

Q That's the bean curd?

A Yes, that's right. But it's becoming quite popular, and more and more people are getting into it.

Q But plain...?

A It's terrible. But we can make it so it's very bland. It's very nice and attractive.

Q Its main attractiveness is it's so adaptable to almost any flavor you want to use it with. Because, as you well know, in my home town of Battle Creek, Michigan, the Sanitarium in the 'Thirties and 'Forties formed a corporation to make soybean simulated meat products.

A Old Dr. Kellogg was very active in that.

Q John Harvey Kellogg. This sort of thing was occurring simultaneously with your research?

A Yes. We went up there quite a lot.

Q To see what they were doing?

A Yeah. Dr. Ruddiman was....

Q Conversant in all these areas?

A Yes.

Q But you were not interested in the food end of it, you were strictly...?

A Our job was industrial.

Q Let's get back to your particular concerns.

A I better tie in the plastic car here. As I say, we got going on plastics of all types, not only the Bakelight, but we eventually got into the structural plastics, which utilized fibers from several different crops.

Q Agricultural fibers?

A Yes, agricultural fibers. I've forgetten the fiber that we finally decided we'd like to use the best.

Q You experimented with ramie, hemp and...?

A Hemp and flax. [Ramie] grows in Egypt. It's the strongest in all fibers.

Q Only in Egypt?

A Commercially, but I don't where else it grows.

Q Where did you buy your supply from?

A I don't know where we got 'em, but we did.

Q Did you ever try and grow it in Dearborn?

A I think so.

Q You did?

A The Ford Farms, of course, were in all of those thousands of acres that he bought up. We knew that on the structure of plastic if we would intermix ramie fibers, if we could get them, or flax -- we even used soy fibers from the soy stalks. But in mixing that with the resin, we made a slurry of the fibers in the water.

Q Which is sort of a gumbo -- a mix?

A Yes. Then we'd mix in there about 30 percent of the resin -- Bakelight resin or soya protein Bakelight type resin is what we finally ended up with.

Q What was the resin compound broken down to? What were its components?

A The way we finally ended up -- phenol formaldehyde was still basic. Now we had takeoffs of phenol: Recorcinol and some that would make it a

little stronger. We were always trying to develop more strength and more water-resistance. That picture that you see us where we have this slurry that we've sucked up out of a tank on to a felt mat about a half an inch thick in the shape of a rear trunk door of a car, and we would transfer that wet slurry, which is held by suction onto this screen over to a hot form -- that same form -- and drive off the water, and then transfer that into a hydraulic press and give it 2000 pounds per square inch at three minutes for 300 degrees, and then you'd come out with a door.

Q A very strong piece of fiber?

A A very tough....

Q Piece of fiber?

A Yes. In the shape of a trunk door, and that's how we made those doors for these pictures.

Q For the rear decklid of the car?

A Yes.

Q Was it adaptable so you could hinge it and hang it?

A Oh, yeah. You could screw into it and everything, and you could repair it, because we had a plastic putty that you could put on there with these infra-red lights, which would give spot heat, and you could repair it.

Q Very adaptable.

A The door he hit with Walter Chrysler where he did....

Q How did he decide to come up with this demonstration decklid -- this rear trunk lid?

A We selected that because it had no undercuts. It's a simple....

Q What does that mean?

A No folds or any.... It was just a straight, curved piece.

Q You didn't have to mold it?

A Yeah. We built a die that was that exact shape, and we made this preform -- a slurry preform -- just exactly the right dimension. The idea was to suck it out of the slurry, dry it, press it.

Q Under heavy hydraulic pressure?

A A ton per square inch.

Q Which he had built for you especially for the Rouge Plant?

A That's another anecdote. When we got to the point where we could make these doors quite easily, we made several hundred of them.

Q When you say doors...?

A Trunk lids. Then Mr. Ford said, "Now let's go and build a whole body out of 'em. Let's don't tell Charlie or Pete Martin."

Q Before you get to that, is this after the famous demonstration with the axe or before?

A It was during that.

Q Before we get to that, let's talk about that famous demonstration. He had decided once you had produced this very durable trunk lid that he wanted to show it off in public? How did that occur -- the demonstration?

A I selected the door, and I remember one of the first ones that we built -- we built it by hand, actually -- I jumped on it and showed him. I said, "Look how tough this is."

Q You put it on the ground?

A Put it on the ground and stomped on it. He said, "Build me one. I'm going to put one on my car."

Q Would it bend and snap back?

A Yeah. Whereas if I'd jumped on a metal door, I'd have bent it in, and it would have been dented. So he said, "Can you put one on my car?" So we did, and he got a big kick out of it hitting it.

Q With an axe?

A Yeah.

Q But not the sharp end of the axe?

A We knew he'd cut through with that.

Q That's interesting, because someone always assumed that it was durable enough to resist the sharp edge of an axe, but it wasn't?

A No.

Q It could have cut right through it if you'd swung it with the sharp side? He simply turned the axe around and used the blunt end of it, and that made no impression whatsoever?

A Yeah. I never actually saw him hit a metal door that way, but I imagine he did somewhere. But he would have dented it, of course.

Q There are other famous pictures, as you know, where you're pointing to something that had made an impression?

A Yeah.

Q Is that a regular metal door?

A He wanted to see. "See there's nothing. I didn't hurt it?"

Q So he would have the normal automobile trunk lid side by side with the fiber panel, and he'd try first one and then the other and show that the axe made quite an impression on the steel but none on the plastic?

A He got a big kick out of that.

Q And, finally, at one time in late 1940, invited the reporters and cameramen in -- at least, the one that was publicized?

A I guess he did.

Q In late 1940, when this publicity surfaced, apparently through his publicity department, he had cameramen and reporters on the scene and was showing the durability of the fiber panel that you had fashioned?

A Yes.

Q And it was written up in Time magazine and Life magazine and Fortune, and you were profiled -- you and your whole project in Dearborn were profiled -- in the business and finance section of Time magazine?

A Yes.

Q So then he got an idea from that that he wanted to expand on it?

A Oh, yeah. He wanted to go ahead.

Q What did he say? How did he broach it to you?

A We were discussing it, and he said, "Let's see if we can't build a whole car out of this plastic." He said, "I don't want Charlie [Sorensen] or Pete Martin to know about it. Keep it quiet."

Q They were his production chiefs?

A Yes. "Keep it quiet." I said to him, "Our problem is we need a press capable of exerting a ton per square inch. I don't know where we can get one of those."

Q How had you done the decklids?

A We made an oversized sheet and trimmed it -- made it fit by hand.

Q And used the Rouge hydraulic press?

A I'm a little hazy on how we did the pressure part on that. I think we made a couple without any pressure, which meant they were way too thick. When we squeezed them down, then they are much thinner and, of course, much stronger, too.

Q But the demonstration rear decklids were not hydraulically...?

A The first ones weren't, because we didn't have the press. It was getting a press that stymied us. One day he and I were driving in the Rouge Plant, and we drove -- why, I don't know -- behind the pressed steel building, and there on a railroad siding on a flat bed car were three hydraulic presses that were 2000 ton presses. They had been ordered to press out brake drums. And I said, "There is what we need!" A press like that. It was a French oil mill press. I've forgotten how many square inches were in that trunk lid, but we had to have a ton on every square inch. These presses were built to take -- they were 2500 ton presses, and they were the biggest thing I've ever seen at the time. I pointed them out and said, "That's what kind of a press we need to make these panels." He said, "Okay, let's take it." And it happened, at that time, they were building the tool and die plant in the Rouge Plant -- a big, new building -- and only about half of it was in use at the time. We went over there, and he said, "Let's take this corner and wall it off -- temporary walls -- and we'll put the press right in here, and don't tell anybody about it, and we'll go ahead with it."

I don't know how the hell I ever got this press stolen from the pressed steel building, but somehow or other we had it moved and covered up in the corner of that building. We started designing dies, and that's when we got Lowell Overly out, who started to design the car.

Q Tell us about Lowell Overly. What was his background?

A I really don't know. He worked in the engineering department at the Rouge Plant.

Q I believe he was an extrusion molder. He had learned that. He had gone through the Trade School.

A Are you sure that wasn't Joe Stewart?

Q I think he was an extrusion engineer.

A Okay. Joe Stewart was the guy that I worked with most of the time, and he was a specialist -- we both learned it together. We went all over the country looking at these new extrusion presses, but we soon found they weren't the answer to our problem. But when we decided to get serious about this car, he said, "Go down and get a good engineer somewhere down there that we can transfer out here for awhile and use him." So, somehow or other, we fastened on Lowell Overly.

Q You don't remember how?

A Not much more than that. But he was transferred out to our lab, and he set him up with a drawing board, and we developed this tubular frame on which we mounted the plastic panels.

Q Before we get to that, I want to ask you something. Mr. Overly has told me that he was asked to come out to work with you on a project which he didn't know anything about.

A That's right.

Q And he remembers that he was working upstairs in the old Greenfield Village lab?

A Yeah. We set him up with a drafting board and everything he needed.

Q And he remembers that he heard Mr. Ford come in downstairs where you were, and he remembers -- now, he may have simplified over the years, but he remembers something like this to the effect that Mr. Ford, apparently, asked you a question, and you said, "I'll go up and ask Mr. Overly." So you came up the wooden stairs and said, "Mr. Ford wants to

know if you want to work on the plastic car," or the project. And he said, "Yes. I'd like that." You go back down the stairs, and you say, "He says, 'Fine.' He says he'll do it." And he heard Mr. Ford say, "Fine. Get him started," or whatever. You guys did start the project together. Did it work something like that?

A That's about right. We didn't want anybody there that was doubtful or wouldn't take a dare or a challenge like that, because a lot of engineers will not get off the beaten track. They don't want any part of it. But Lowell worked out great.

Q He was adaptable?

A Very.

Q But you don't think he had any extrusion molding experience?

A Not that I was aware of.

Q Who was the other gentleman you mentioned?

A Joe Stewart.

Q Was he an engineer?

A He was in Bill Pioch's design group. He was supposed to be specializing in extrusion only, because that was the new technique coming along. He and I went around looking at new machines and all of that sort of thing, and we actually put in an extrusion molding department.

Q Where?

A Somewhere in the Rouge Plant. I've forgotten where. I wasn't too much involved in that end of it. We were....

Q When you say we, you mean the company or Mr. Ford?

A I mean our group out at the Village.

Q How many has it grown to by this time? Is this 1940?

A Yes. We varied, depending on the activity at the moment, but, I had about fifteen that I would call basic crew.

Q That you had selected from various sources?

A That were in charge. For instance, we were developing paints, and the fiber, and a lot of other things. A lot of projects were going on at the same time.

Q You had several projects at once?

A Yes. Here's another anecdote. Let's finish this plastic thing first. One of Lowell's first jobs was to design the mold to make the trunk lid. That was quite an intricate design.

Q Was this other gentleman helping?

A Joe Stewart. No, he wasn't in on the plastic car at all. He was mostly doing Rouge Plant stuff, and he'd been assigned to study the plastic injection molding development.

Q So he was your initial expert advisor on that aspect?

A Right. But in designing this mold for the trunk lid, we knew that what we needed was a ton per square inch. If we built a mold, we could have as many as we wanted in there, and that same one ton per square inch would treat all layers, and this was the way we hoped to compete with steel and cost.

Q You could do twelve at once?

A Yes. Or many more, depending how big we built the.... And we built a mold with three platens, so that we could mold.... We had a patent, and Mr. Ford and I are on it, and I'm not sure whether Lowell is on that patent or not.

Q For that...?

A For that design mold. We had made -- all secret, as far as we knew....

Q You even kept the secret from Charlie and Pete?

A How we ever did that, I don't know. This is where the intrigue came in that I mentioned. So we got the mold made and the machine, and we put it in the press, and one afternoon at five o'clock we decided we were ready to try a test run. Quarter to five, who comes in, but Charlie Sorensen, Martin, Ray Rausch, all of the big shots, and they stood around and watched this.

Q They weren't just making an accidental entry?

A No. They knew, of course.

Q So they had tumbled to the whole thing?

A Mr. Ford wasn't there.

Q Why wasn't he there for the first run?

A I don't know. Maybe he was out of town or something. I've forgotten. Lowell and I and the fellows that worked on it, we thought we better have some practice before we showed it off in public, but we never did. The very first run we had all these fellows.

Q So you've got Sorensen, Martin...?

A Ray Rausch and there some more. All of the top management of the Rouge Plant came. We put the charge in, put in three preforms, and shut the press up, and I'll be darned if one of the intermediate platens didn't crack.

Q What was the problem?

A Apparently, it wasn't accurate enough, and when this 2500 tons of pressure came on it, it just cracked. It didn't hurt anything, except we

got a little steam leak. One of the basics of our patent on this mold was that we had it channeled -- it was a casting -- and we had it channeled so that at each end we'd have a header, and we'd let the steam come in one end, and then after three minutes, water would come in the other and cool it.

Q And then it would solidify?

A Yes. We got a patent on the design of that. It only took about twenty seconds to go from 300 degrees to cool, so our time limit per cycle was quite low. To tell you what we had to go through, we had to install 400 feet of four inch piping for both water and steam to this mold. It wasn't cheap.

Q You had a port injection for each level of platen?

A Yes. We has a flexible hosing for that. Actually, in that first shot, we made three doors, and they came out right, even though that one mold cracked.

Q What did the surrounding assemblage think?

A I don't know. Of course, I was so concerned. I was upset that we had a little leak of steam and water. I don't remember being complimented or anything like that! But we fixed that platen, and when Mr. Ford came down, and we made a run for him, everything worked all right, and he was very pleased.

Q You had three at that time?

A Yeah.

Q And then what did you decide to do? Had you decided to make it?

A That's when we started on the design of the car itself.

Q Back up a bit. Have you already done the tubular frame by this time?

A That was coming along simultaneously.

Q Who was doing that?

A Lowell designed it.

Q Lowell was designing the tubular frame and putting it together?

A Yes.

Q In the building at Greenfield Village?

A That's where he had his drawing board.

Q But you went over to the Rouge?

A The car was actually assembled up in the garage back of the Engineering Lab.

Q Oh, really?

A Yeah. Where Ray Dallinger's service department was, and that's where the picture was taken was over in that building -- the full-size one, I mean.

Q So Lowell is working on the tubular frame?

A By that time, it wasn't secret any more.

Q So that was utilizing his engineering abilities, whatever they were, and he was designing and putting together the tubular frame?

A Yes. We had to develop ways of fastening the plastic panel to the tube.

Q And you are coming up with the panels under this great hydraulic pressure press, which will hang on this frame?

A Yeah. But we realized, before we'd gone too far, that we were going to have to have all kinds of presses, shapes for all of the different shaped panels of the car, and it was going to be too costly.

Q At this point, has Lowell or you made any preliminary design sketches for the exterior?

A Oh, yeah. We made [scale] clay models.

Q I've seen pictures of those. This had been done before you did the panel mold? You were making clay models of what shape you were hoping to...?

A We knew we could make a good panel with enough pressure, but we also realized that to make a car was going to take a lot more presses than we had, and it was, obviously, impractical to do that. So we went back to the technique of making the preform but not squeezing it under heat and pressure. We baked it in an oven. Then we hand finished it.

Q Under what kind of heat?

A 300 degrees. And we did a lot of hand work on those.

Q You'd sand and smooth the edge?

A Yes. If you look at the pictures, you can see on the front fenders, it's pretty thick. It had never been under hydraulic pressure, but they were tough.

Q You also had problems, as I suspect, in my naive, layman's mind here, that you wanted to bend them slightly to round them. Did you have a process that could do that?

A Yes. It was quite cheap to make a preform mold. That was nothing but screening, anyway. So we could do most any shape we wanted and then just dip it in the slurry. We'd have to put suction on it and suck it out and then pat it.

Q So the common misconception that the parts of the final plastic car were formed under hydraulic pressure is erroneous?

A The first car wasn't. Not at all. But on a production car, it would have been.

Q It would have had to have been?

A Yeah.

Q So Lowell Overly has made the 3/8th mold, roughly?

A Yes.

Q A miniature clay, and he has made the configurations that you and Mr. Ford want, and you are ready to try and duplicate that in full scale?

A Right.

Q You've got the tubular frame ready to go. You've got the wheels and the tires on it?

A We used the small V-8 engine.

Q You've got a radiator, obviously?

A Oh, yeah.

Q And the chassis is adapted to having the exhaust and all the components on a regular chassis?

A Yes.

Q Then what happened?

A We built the car.

Q You're in the garage of the engineering lab, and you've made the preforms to the specifications that you want.

A Clamps that would do that, and the fact that we were using unpressed panels without the hydraulic pressure made it quite easy for us to go in there with screws. So these panels were just hanging onto that frame. They were not load bearing. They were very easy to fasten on. When we had joints or cracks, we developed this plastic putty that we could seal up the joints. And then we heated it with infra-red lamps.

Q So that, in effect, joins the panels...?

A And sets them up and fuses them together. And then, of course, we had to do some hand work -- sanding -- to smooth it over.

Q I've often wondered about the paint. It looks like it's white.

A It was between yellow and white.

Q Sort of an oyster?

A It was definitely yellow. It wasn't too flashy.

Q Who decided on that color?

A I don't know.

Q Did you paint it?

A We painted it up there in the....

Q Was it hand-painted or sprayed?

A Sprayed.

Q In the engineering laboratory garage.

A I remember Lowell and I, we were debating what to do about the radiator decoration, and we finally came up with.... You'll notice that we have the vertical strips. We realized those were being used somewhere in production. They were extruded plastic. Dark brown plastic. So we just got some of that and cut it off to the right size and fastened them to the radiator.

Q You found them somewhere in the automotive section?

A They were using them somewhere in the Rouge Plant. I've forgotten how we found them. But that settled that problem. We didn't want to have to build a special grille mold and fool around that way.

Q So you just adhered them to the front of the radiator?

A Yeah. That was one of the first cars that didn't have a running board, too.

Q That's right. The Lincoln Zephyr had pioneered it, but very few others had.

A That's right.

Q And that was deliberate?

A Oh, yeah. We didn't want....

Q To attach a running board to the plastic panels. Even though you probably could have it would have been awkward?

A Yeah, but it was....

Q Too much stress?

A From then on, all automotive design was away from running boards.

Q You mentioned earlier that these preforms, not hydraulically pressed, would not stand much stress?

A They were quite rigid. They were surprisingly strong, but we could have made them stronger with the pressure.

Q You also fashioned an interior that was reasonably close to the production Ford at the time?

A Yes.

Q Did you use the standard seats and cushions?

A We didn't finish off the rear seat. We had a standard front seat, and three people could sit on it. I took the car home for a couple of weeks. My kids would drive it at night.

Q Mr. Ford decided to have some publicity shots taken, and there are several which are still in existence: one showing Mr. Overly at the wheel without a hat. Tell me about the windshield. How did you fashion the windshield or the glass? Was it made out of glass, or was it made out...?

A There were two showings of this car; one was at a special Dearborn Day event. They had it, I guess, once every year in a little park.

Q Ford Field?

A I'm not sure where Ford Field is.

Q That's in Dearborn.

A It was a public park. That probably was George Ebling, but, maybe, some news reporters were there, too. But also in the Michigan State Fair in August of that year was where we really showed it. It was featured out there.

Q August of...?

A '41.

Q That was the real public exposure?

A Yes. That's why we put the license plate on -- 1941.

Q Right.

A The Michigan State Fair, I remember it because they had a Japanese Zero fighter that had been shot down, and it was right next to us. That was before Pearl Harbor.

Q What sort of reception did [the plastic car] get at the Fair? Were you out there every day or so?

A I didn't tend the booth or anything like that, and I'm not sure Lowell was out there either.

Q But you had gone occasionally, both of you?

A We had attendants out there, of course.

Q You'd gotten a lot of national press recognition?

A Oh, yeah. It was strictly handmade, but it proved a point.

Q But it was driveable?

A Oh, yeah. Oh, sure.

Q Because you drove it home, and you took your kids and your wife for a ride in it?

A Yes.

Q So there you are, you've got this driveable model, the publicity is tremendous, and Mr. Ford is pleased with the reception of the automobile?

A Yes.

Q Was he pleased with the final mold? He indicated that you guys had done a good job?

A Yeah, I think so. He was proud to show it off.

Q Yes, he was. So the through was, at that time, as indicated in articles that I've read, that he was -- what was he planning for the plastic car? What was his basic aim?

A Again, to provide industrial markets for farmers. But we knew we had an awful lot of work to do to make it economical to compete with steel.

Q You hadn't really whipped that problem, had you?

A Not really for intricate designs. The trunk lid was relatively easy, but when you get into the more curvature designs, it would have been....

Q The big problem was to curve it under pressure?

A Right. We knew we were going to have to stack it. If you have a deep draw or curve, you would be limited as to how high you could stack it. It was going to be a tough problem. But, as I say, the war solved all that for us.

Q But before the war started -- this is in the Fall of '41 -- Mr. Ford is gung-ho about you and Mr. Overly and others going ahead with your research to try to solve this problem of shaping it into a recognizable automobile form?

A Right. Along at the same time, though, the war fever was dominating everybody's thoughts.

Q That mid-summer was a very hectic time.?

A Yeah. He sent me out to Los Angeles, and I visited every large airplane manufacturer to see if we could do anything in producing planes from structural plastic.

Q The plastic industry was really just getting started, in effect?

A Well, yeah. Howard Hughes had built a single-seater, fighter-type plane completely out of plywood, and he bent the plywood enough to make a shape of a wing and everything.

Q Under heat?

A Yeah. The idea was to see whether we could use our technology and produce parts for the planes. Somewhere along in that area, Mr. Ford had a visit from General Hap Arnold, who was head of the Air Force.

Q H.H. Arnold?

A Yeah. And they were having lunch down at the Rouge Plant in the dining room.

Q Was that in mid-'41?

A In that area, because he sent for me. Jimmy Doolittle was there, too. They'd been discussing the possible use of plastics in airplanes.

Q Had airplanes had any plastic interiors at all?

A Other than the plexiglass.

Q Some Bakelight, possibly?

A Yeah, little stuff. Nothing structural. So they sent for me. Arnold said, "Do you think you could make a wing out of plastic?" I said, "We can make the shape. I don't how strong or tough we can make it for you." He said, "Well, why don't we give you a research contract and build a few for us?" "Okay."

Q And Mr. Ford was agreeable?

A Oh, yeah. He wanted us to go gung-ho on it. So we got a research contract from Wright Field -- a hundred thousand dollars or something like that -- to build one wing of a fighter plane. Just one wing is all we had to do. We built it with this technique and got it down there, and they tortured it -- put it through testing.

Q But how did you curve it? Obviously, you wanted an aerodynamic curve?

A We built a mold for the wing tip. I took that down to Wright Field, and that's where they tested it. Young's Modulus is the key to the stiffness, in effect.

Q Is that named after the man that formulated it?

A It's a law of physics and Young developed it. I'm a little hazy on the technical aspects of it, but, in effect, it's a measure of stiffness to weight. That's one reason why they use aluminum instead of some other material in airplanes, because aluminum has a pretty high Young's Modulus. But we were even higher for weight. The impact strength was a little low; we were too stiff. We fractured instead of give, whereas aluminum will give a little. And we were working on that. We finally built a complete wing, and they tested it, and it wasn't quite strong

enough. It wasn't what they really wanted. But we did the contract. We finished the contract.

Q What sort of stress analysis would they put it under?

A They had all kinds of testing machines down there. Bending strength was one of their keys. They put a load in the middle of it and measured deflection.

Q How about its durability? Would they try to crush it or smash it?

A Oh, they did. They actually destroyed it.

Q It passed most of the tests?

A Yeah. I don't know what would have happened if we'd gone on, and I don't know why we quite, except everything stopped there in 1943.

Q But you finished out the contract?

A Oh, yes.

Q Was it durable enough to stop a bullet?

A No.

Q But normal air pressure would deflect it without breaking up?

A I think so.

Q And you could bend it to make it an aerodynamic...?

A Of course, money was no object to the Air Force. They'd have built us any kind of press we wanted if we could get an article that was satisfactory.

Q But it wasn't quite satisfactory?

A No. It needed a lot more work.

Q But the contract came to the end?

A Yeah. And it just wasn't pursued.

Q Was Arnold pleased with what you had done?

A Well, I don't know whether he ever heard....

Q The Air Force people at Wright?

A Oh, yeah. They were the ones that oversaw all of those types of contracts. They had a lot of research contracts.

Q This was just one of them?

A This was just one little dinky one.

Q But it was an important one?

A I could have been.

Q And it presaged a tremendous boom after the war in that kind of product -- even during the war?

A Right.

Q But, at the time, it was just another research project?

A I think we were a little heavy, too.

Q You weren't as light as you...?

A Yeah. That was the trouble with Howard Hughes' plane, he had....

Q Wood?

A Plywood. And it was strong enough, but it was too heavy.

Q Was the refinement of that later to become the Spruce Goose?

A Some of that technology was, yes. That was pretty heavy, too.

Q I thought plywood could be reduced to a rather light substance?

A It can.

Q Thin but durable substance.

A The Mosquito Bomber in England was all plywood.

Q What was that called? Bonded by sound waves. Iron Mountain was working with plywood, or, at least, bonded wood, until after the war?

A I never was up to Iron Mountain. I don't know. The station wagons I saw were just wood, not plywood.

Q So the Air Force contract comes to an end, and what year is this, '42?

A It was in that area. I can't pinpoint the exact date.

Q You were doing other projects at the soybean lab. What other projects were you working on besides the plastic panels?

A Well, on the fiber, of course, that was big one, but we had quite a....

Q Let me back up a little more. Except for yourself, of course, and the people who read the plastic journals at the time of your experiment, it is a common-held assumption -- and I find this all the time when people are writing and calling me -- that those panels you made were made out of soybean?

A That's not true.

Q Can you give us the composition, as I think you have partly throughout our interview -- the exact composition of those panels?

A We had several alternative formulas. But, basically, they were phenol formaldehyde resin.

Q Which was the basic bonding agent...?

A For the fibers.

Q The ramie, the hemp?

A The structural fibers.

Q The heavy agricultural fiber products that you used, and it was phenol formaldehyde resin that...?

A Held it together, and, of course, gave it waterproofness.

Q There were no other elements in that?

A There were several resins that we tried. For instance, urea formaldehyde was pretty good, but it was more expensive. And resorcinal, to

take the place of phenol.

Q That was tried in place of phenol?

A Yeah. Phenol was relatively expensive in those days. Coal tar. It's off of coke ovens.

Q Distilled of the coke elements, which you had plenty of right next door, did you not? You could have all you wanted?

A They didn't produce much. Hard coke ovens were mainly producing amonium sulphate and the Benzol.

Q That's another whole story. Were you ever involved in that?

A No.

Q That was a light oil distillate of the coke-making process?

A Right.

Q So you tried several compounds, but the phenol formaldehyde seemed to be the best bonding agent?

A Was the basic one. In those days, that was before glass fiber really was available.

Q The Libby-Owens-Ford people hadn't really come up with that?

A Not yet. They were working on it, and they were making mineral wool from slag and that sort of thing, but they hadn't come out with a real good fiber yet. Today, the Chevrolet Corvette is made out of fiberglass. They get pretty good strength with that.

Q But that process was strictly in the laboratory at the time?

A Yeah.

Q And it wasn't feasible yet?

A Yes, that's right.

Q So it's been fairly successful, and you've excited the world press, and, especially, the industry press is fascinated, and several

technical articles were written in the plastic industry press. You've worked with the Air Force, and now where are you at this juncture, say sometime in 1942? Are you going to plug into the war effort in any other way?

A We got involved out at Willow Run.

Q How did that happen?

A They wanted somebody to oversee the plexiglass that went into the bombers.

Q Now was this a new process?

A No. Plexiglass was available commercially.

Q What were its uses?

A Mostly the decorative stuff when it first came out, but finally they developed transparent panels, like glass.

Q Which would take the place of glass?

A Yeah. And that's what they used them for on the bombers. The bomb turrets.

Q It wouldn't shatter dangerously like glass would if a bullet hit it?

A Right. The B-24 is what we made at Willow Run. They'd get 'em over to North Africa and one take off and one landing in the sand, and they couldn't see out of it.

Q It would be so pitted, that their vision would be impaired?

A They'd have to put a new one on every day.

Q That was terribly expensive?

A Oh, terrible.

Q Did you work on that problem?

A No, I didn't. I was involved in protecting it while it was in the Willow Run Plant.

Q Protecting the...?

A The plexiglass. We would get them installed on the bomber, and then they'd fly them away, and that's the last we ever heard of 'em. We heard about the problem, but....

Q There were several desert theaters in North Africa?

A Oh, yeah. The B-24 was used in North Africa quite a lot.

Q It was their mainstay?

A Yes. I suppose the Boeing B-17's have the same problem.

Q But they were used largely in Europe?

A Yeah. They weren't in the sand.

Q Were you involved in this?

A We didn't work on them.

Q Did they ever come up with a compound that would resist sand pitting?

A I don't think they did.

Q So you were over there working on the plexiglass windshields for the B-24?

A That was my war stint there.

Q That lasted how long?

A Until everything folded up there.

Q Edsel Ford had died?

A Yeah.

Q And that was, obviously, a very traumatic event in the Ford Motor Company and the Ford family?

A And the family, yes.

Q What practical consequences were there in terms of your project?

A I don't follow you.

Q Step by step, Edsel had been ailing for a couple of years, and he then died in the Spring of 1943 of what was later diagnosed as stomach cancer, and this has a profound effect on Mr. Ford. How did it affect your operation?

A I knew, somehow or other, that we were going to stop all of our operations over there.

Q You had a premonition that this...?

A Not only that, but the Air Force made no bones about wanting our building.

Q This is the point where the Pratt & Whitney people want that air conditioned laboratory on Oakwood Boulevard?

A And at the same time, also, the Internal Revenue was complaining that....

Q Why were they unhappy?

A Because we were doing postwar work on this fiber work for a profit for the Ford Motor Company and doing it in a tax-free plant.

Q Which was Greenfield Village?

A Yeah. And they said, "You can't do that. You'll have to stop all civilian work or all work that might be to a profit. It could upset the whole Edison Institute organization."

Q You'd have to start paying taxes?

A That's right. And so all of these thing hit at once. And I had just about decided -- well, there's one other factor; my wife became

ill. The doctor said, "I think you'd better get her a change. Move out of town. Give her a change."

Q Did she have respiratory problems?

A No, mostly mental.

Q She needed a change of scene?

A Yes. She went over to the Ford Hospital, and they did everything they could for her, but they couldn't do much. So when the offer came from the Drackett Company in Cincinnati, I took it.

Q Tell us about that offer.

A Mr. H.R. Drackett, as I say, had built this soybean plant, and he wanted to get into more basic soy processing. When he heard that....

Q Why was he interested in soybeans? He's a chemical manufacturer, was he not?

A Well, Drano, but all that is nothing but mixing. There's no processing in it.

Q Had he invented Windex by this time?

A Yeah.

Q And he had, as you said earlier, an embarrassing amount of profits, and he was a public-spirited gentleman?

A He was.

Q So he looked around, and he found the soybean would fit his...?

A And it looked like it had a very good future, and, of course, it did.

Q Commercial and a possibility for implementing it?

A Yeah. So he came up and made this offer.

Q He knew about your national attention?

A Actually, he had sent his research man up to see ours, and I got to know him quite well.

Q What was his name?

A Dr. Gangloff. Very nice, very competent.

Q He was a PhD in chemistry?

A I think so. He was a doctor. Anyway, when the offer came from Mr. Drackett, I took it, because I wanted to get my wife out of Detroit. I could see that we weren't going to be able to carry on the work with the Air Force, so I submitted my resignation. It was just before Edsel died, really. I think I gave them a month.

Q So, in effect, you really made up your mind before the project was given the axe?

A No, because I can remember dismantling some of the equipment. It had already stopped, and I remember walking through the building and seeing this equipment being dismantled.

Q Do you think the pressure of the wartime activities of the company were such that Mr. Ford had less and less time to think about your project?

A With Edsel's condition, he decided to step back in and run the company. He became president again.

Q But you had made the decision to retire before Edsel died?

A Yeah, but we knew he was very ill, and Mr. Ford was very upset.

Q You decided to leave the project. Was Mr. Ford sad that you decided to pull out?

A I think so. I never saw him after I told Mr. Campsall I was leaving, but he wrote me letters and Ed Campsall called up several times and said, "How are you doing?"

Q In Cincinnati?

A Yeah. And invited me back, which I didn't go. I went back for his funeral. That's the last of it.

Q So from the time you left and you decided to tell Mr. Campsall that you were leaving, you gave a month's notice?

A I think that's about it.

Q What did Mr. Campsall say when you said you were leaving?

A There was nothing he could say. I don't recall anything outstanding.

Q Was he sympathetic with the effort you were making over the last twelve months?

A He said, "It sounds like a good opportunity for you." It was a lot more money.

Q By this time did you have academic credentials in chemistry, or were you pretty much...?

A No.

Q But Mr. Drackett knew of your...?

A He knew the whole story.

Q And he wanted your research experience more than the academic degrees?

A Yes.

Q So there you are in Cincinnati, and what type of projects does he have you working on?

A We took the fiber plant. He bought that equipment. He bought all the equipment, and we set up there in Cincinnati.

Q And you took some of your staff with you?

A Yeah.

Q That you could get to come who weren't being drafted?

A Hadn't been, anyway. I know I was 3-A.

Q What sort of projects? Is Mr. Drackett continuing, in a sense, your soybean reduction extraction?

A Well, he died.

Q What year did he die?

A 1949, I think it was.

Q For six years you're...?

A I spent about five or six years there.

Q You're with the Drackett company under his benevolent aegis, what sort of research projects are you working on?

A We were working on the fiber, and we'd set that equipment up. We were making more fiber and trying to develop markets for it.

Q Had you licked the problem?

A We always wanted more wet strength.

Q In case you were caught out in the rain?

A Yeah. We didn't want your pants to break open at the knees. We did develop this relationship with the hat corporation. We sold them a lot of fiber, and we decided to build a bigger plant.

Q In Cincinnati?

A Which we did. But that meant we had to build a protein plant, too, in order to make the fiber. And we built it big enough [to satisfy their demands].

Q In the preliminary discussions about the design of the plastic car -- the exterior design -- was, as I understand from Mr. Overly, the Ford

design department, occupying the South end of the Engineering Laboratory, Mr. Zoerlein's space, were they consulted on a preliminary design proposal?

A To the best of my recollection, very little contact was had with them. I remember talking with Gregorie several times, but I'm trying to think of who actually might have made the first clay model.

Q Of the design department's proposal?

A Yes. It could well be that they made the first clay model, and then we took it over and refined it ourselves.

Q I understand Mr. Ford, or you, or Mr. Overly did not particularly like their first design, and you either redid it or refined it?

A I'm hazy on that. Right now my first recollection of a clay model was in our laboratory down in [Greenfield] Village.

Q That you and Mr. Overly worked on?

A Yeah. That's fun work. We enjoyed playing with the clay. But we actually made a clay model, and we had it on that table there where Mr. Ford always sat and discussed it with him. And, of course, we were conscious of trying to keep the undercut and contour shape as simple as possible. We knew the limitations of our plastic technology, whereas Gregorie and his group did not.

Q So they came up with something far more sophisticated?

A That's possible, yes. That could well be.

Q The photographs of the model showing you, and Mr. Overly and Mr. Ford looking at the small -- was it a 3/8th scale?

A I think so.

Q Which was the standard scale model of that time. It looks remarkably close to the finished product, does it not?

A Yes.

Q So I suspect that Mr. Ford must have said that's it?

A Yes.

Q Apparently, you have either made your own clay model or taken the design department's clay model and refined it and reshaped it, one or the other, or both? Did you do several scale clay models?

A Yes. We worked quite awhile on that.

Q You didn't make a full-size clay.

A No.

Q So, we're back in Cincinnati, and Mr. Drackett is enthusiastic about your soybean isolation, and you find that you need a much larger building because of what? For what reason?

A We felt that there was a big future in soy protein, as such, but it could be used in many things. So we decided to build a larger plant than we needed just to supply our fiber operation. We figured we'd have some to sell. We also had a big plastics operation down there. We built a plant for it -- for high-impact plastic, not structural, but high-impact.

Q Give us an example.

A Something that could absorb a heavy blow without shattering or breaking. I can't think of what the finished products would be right now, but we built a plant especially for this structural plastic. As it turned out, it did not require soybean, finally. We thought it would at first use some protein.

Q But you had had some experience with the instability of the soybean?

A We had a hard time getting the water resistance to the point where we wanted it. But all of these projects were pretty big operations for the Drackett company, which wasn't really all that big. They had a lot of money, but they weren't....

Q They hadn't really expanded that much?

A No. Actually, the rest of the management were market people -- knew how to market Windex and Drano and did a wonderful job -- but they had no feeling for the soybean operation, and when he died, they decided to move out, and they sold the whole soybean plant to Archer-Daniels [Midland].

Q Before he died, you were coming up with salable products?

A Oh, yeah.

Q But they couldn't find the marketing or the advertising promotional people to push it during the wartime market?

A Oh, no. We were making money on the plastic and the fiber.

Q What sort of products were you turning out that are recognizable products, or were you making bulk supplies of plastic?

A We were making the bulk plastic material, which we would sell to other molders who would mold it into whatever finished products they made.

Q What was the composition that was most successful?

A Again, this was phenol formaldehyde plus fiber that we....

Q Still pretty much the heavy fiber: flax, ramie, hemp and others.

A Yes. I think the hemp was the best -- cheapest.

Q And that was available as well?

A Oh, yes.

Q But your division was making money?

A Yes. And we expected, when we finally got the fiber plant going, that it would be quite profitable.

Q This was just after the war ended?

A Yes. We were still in a war psychology.

Q Did you supply plastics to industries that were making war material, or didn't you follow it that closely?

A We didn't hit the market at Drackett until after the war was over.

Q Your sales were in bulk plastic?

A Yes. We were building the plant before then, but we didn't actually have anything to sell until after the war.

Q But, obviously, the plastics industry just literally exploded after the end of World War II when all restrictions were off, and the sky was the limit?

A Right.

Q So you expected a rather bright future in this division?

A Yes.

Q And Mr. Drackett was also enthusiastic?

A Oh, yes. He supported us.

Q And gung-ho about moving ahead -- expanding -- and then suddenly he died? That was another trauma?

A Oh, yeah. That really changed that company around.

Q None of the family took over -- his sons?

A He had a son in it, but he was not interested in chemistry. He was a Harvard Business School graduate.

Q But you were making a profit?

A Yeah, but he was more interested in making a profit with Windex and Drano and products of that type. We had a lot of research work going on in new grocery store type products. But Archer Daniels came along and bought the plant.

Q Who was Archer Daniels?

A They were one of the first soybean processors in the country.

Q Where were they located?

A Their home office is Minneapolis, but they have a big operation Decatur, Illinois.

Q They were largely foodstuffs?

A Food and bulk oil.

Q But they weren't interested in the plastic?

A No, they weren't, really.

Q They just wanted your soybean reduction machinery and expertise?

A They believed that there was a future in soy protein.

Q They were going beyond the foodstuffs?

A This could be either industrial -- at that time industrial paper coating was a big deal. All of these slick magazines are now using soy protein.

Q More than then? Beginning to grow?

A Yes. We had a color problem that we had to lick. It was slightly off white, and some of the fancy magazines wanted a dead white. It took us a few years to solve that.

Q How did you accomplish this?

A Bleaching compounds. But Archer-Daniels finally closed that plant down and then sold it to another company -- Central Soya -- who used it

just for their storage. We had a million bushels storage elevator there.

Q Did Archer-Daniels propose that they take you along?

A No. I had nothing -- this was after....

Q You were not part of the package?

A I left Drackett right after Mr. Drackett died. I could see what was going to happen.

Q You knew that the son was not interested in plastic, he just wanted to sell Drano?

A That's right. I left and went out on this edible fiber deal of mine where I owned the patents.

Q You had the patent, and you felt there was a definite future for it. Edible by humans and animals?

A By humans. It's automatic. If you get it good enough for humans, it's good enough for animals.

Q But I would think that animals would be discerning, perhaps more than humans?

A That's right, but they don't pay much money for animal feed.

Q So what type of human edible products were you proposing to make out of this soybean?

A My idea, which really occurred to me while we were up at Dearborn in the fiber plant -- I'll have to explain it. One of our operations when we spun the fiber, we went through an acid bath, and then we had to go through a washing process, and we used....

Q What did the acid bath do?

A We dissolved the protein first and made a liquid solution out of

it. We called that our spinning dope, and we'd pump that through a spinnerette or die with a lot of little holes in it, which was immersed in this acid.

Q What kind of acid?

A In edible plants it's vinegar.

Q That's acidic acid?

A Yes. But in industrial protein, it would be sulfuric. You couldn't do that with the [edible]. As these streamlets of protein were coagulating in the acid, we'd bleed through the bath about thirty-six inches, and that would be fully coagulated, and then we'd take it over reels and then through washing.

Q I've seen those photographs.

A It was necessary to get all of this acid, and there was salt there, too, out of the fiber. In order to determine that, we could analyze it chemically, but it would take several hours, so the easiest way was to taste it. We'd take this fiber as it was coming out of our washing machine, and you could tell if you'd washed it thoroughly enough.

Q By the taste?

A Taste. You can tell if it's salty or not. Or if it's sour, it'd be tangy.

Q Why would it be sour or tangy?

A If we didn't wash it thoroughly. It had been carried over, you see? It turned out to be quite a difficult washing job for edible. We had to get rid of it all.

One day I was sitting there chewing on it, and it suddenly occurred to me, I said, "What the hell, if we can make a fiber from soy protein

that resembles the outside of a sheep, why not make a fiber that will resemble the inside." In other words, an edible fiber. Up until that point, all of our thoughts and efforts had been inedible fiber.

Q Inedible means not digestible?

A Yes.

Q Had you ever swallowed any of this stuff?

A No, because it was terrible. Too tough for one thing.

Q Oh, it was too tough?

A Sure. Because it had gone through formaldehyde and everything else. And to make an edible fiber, you wouldn't dare go through formaldehyde. But, anyway, it occurred to me, if we can do that for outside, let's do it on the inside. The idea sounded too far fetched, and I didn't seriously....

Q You kept it in the back of your mind?

A I never could get it out of mind.

Q Did you ever broach it to Mr. Ford?

A No, I didn't. Things were falling apart by that time, so I never got around to that. I'm just sorry that he wasn't around to really work on that idea, because it was right up his alley. That idea just bugged me.

Q Let me ask you one question. Back to the plastic car. The word formaldehyde reminded me again there was a contemporary observation that it was a great idea, and it was certainly earth-shaking, but it had one drawback, it smelled like a mortuary because of the formaldehyde. Was that true?

A That's possible.

Q You couldn't rid it of the formaldehyde smell?

A We could if we wanted to. We didn't. We just didn't spend time on it. We could have done that. But we had enough free formaldehyde around that car that you could smell it.

Q You're beginning to master the process of edible protein?

A No. We really didn't start building an edible protein plant until I got down to Cincinnati. At Ford, we never even tried. When we got there....

Q You approached Mr. Drackett, and what did he say?

A He said, "That looks pretty good."

Q Was he fairly adaptable/flexible to innovative ideas like this?

A Yes. He was very educated. He was a well-trained man. But we never really did anything with an edible fiber at Drackett. We had this industrial plant going, and it took all of our efforts to work that one out.

Q You never really got it going?

A We didn't try. We spent all of our efforts on industrial protein.

Q That's where the profits were at that time?

A Right. But after I left Drackett, I decided to investigate the real possibilities of an edible fiber and checked all the patents. I had patent lawyers check over the literature for me and could find nothing; nothing in the way of an edible fiber. In Germany there had been ersatz hamburgers, which were terrible.

Q During the war. They were sawdust, weren't they?

A Yeah, pretty much.

Q Sawdust impregnated with animal blood.

A So I applied for a patent. Nobody had ever really seriously done anything about an edible fiber.

Q Were you recognized as the person who really came up with this?

A It's a benchmark pioneer patent with the patent office. Absolutely no prior art which is almost unheard of. Nothing.

Q No provenance? It came out of your fertile imagination?

A That's right. We were still in a war psychology, so I made a prototype in my own basement of a pork chop.

Q You mixed it up in your basement?

A Yes. I took that out to a company that was then trying to spin a corn protein fiber -- corn gluten. This was Virginia Carolina Chemical Company. They said they weren't able to tackle this new project, but they were very interested, and they would let me use their pilot plant if I provided my own supplies and equipment.

Q Where was that?

A This was in Taftville, Connecticut. They'd taken an old textile plant and remodeled it and were trying to spin corn protein fiber. So I took them up on it. I went up there and took some of my own protein and spun my own edible fiber. I made enough fiber so that I could make ham and prototype stuff, which I then went to various food companies to see if I could sell the idea, and I did. The first company I went to -- they were tied in with Taftville -- Corn Products Company produced the gluten that the Taftville people were spinning. They were interested in that process. So when I showed them these food samples made out of soy protein, they said, "Can you do that out of corn protein?" I said, "I don't know. I'll have to try it." They said, "Well, all right, we'll give you

a research contract for six months and see what we can do with it because we want to sell corn gluten." So for six months I worked with Corn Products, but we never could get rid of the disagreeable flavor of corn protein. It's too raw, too rough.

Q You couldn't cover it up with sugar?

A It comes through. You can even smell it when you drive through a field of corn growing, you can smell it. So I was still on my own and running out of money as a consultant. So I decided to go up to Chicago to the meat people, and if they weren't interested, then I was going to drop it and just forget it.

So I went up to Swift, showed them a couple of samples, and within half a day, they said, "We're going to give you a letter of intent. We want this." So they did.

Q It's like credit?

A Yeah. They didn't want me to go to Armour across the street. I went to Swift first, and I never got out of there.

Q What had you fashioned for them that they were so entranced with?

A I tried to make something that looked like a pork chop.

Q Which you'd made in your basement?

A Yes. I smoked some and colored it pink so that it looked like ham.

Q What about the taste?

A It wasn't <u>bad</u>.

Q How did you make the taste come up?

A You use hydralized vegetable protein, which is a meat type flavor.

Q What had they been using hydralized vegetable protein for before?

A Bouillon cubes and that kind of stuff.

Q You mean to say they would take the beef essence and use the vegetable protein to make the bouillon cube?

A No. When they hydralized, it means that they boiled the soy protein or vegetable protein. Partially broke it down, and it develops flavor when you do that.

Q What would be the vegetable that they normally would use?

A The Chinese use soy. In this country they're using wheat and soy both.

Q So you used that to give it...?

A Give it a meat-like flavor, and then I put in smoke and, of course, spices.

Q What kind of spices?

A In the ham, I used cloves and that sort of thing that you normally use.

Q To simulate the baked ham?

A Yes. The thing that appealed to Swift (I had no idea what I was doing) was it reminded them of thuringer sausage, which is a meat derivative. It's a sausage type of product that's fermented. It's a mixture of meats, but it's fermented, and it develops a very nice flavor. It's very popular in Germany. It's very expensive to make.

Q With the large German population in this country....

A This is one of their first thoughts where they could use this idea. Also, Swift had just come through a traumatic experience. They had turned down the invention of hot dog casing -- the cellophane casings.

Q You mean the natural....

A Not the natural, but they had turned down the idea of producing this out of cellulose, and that turned out to be a very big improvement

in the meat industry. The Visking Corporation then developed it and became.... Swift had lost out on it.

Q You mean all the non-natural casing frankfurters are encased in...?

A In cellophane.

Q With the cellulose cover -- an edible cellulose cover?

A It's not edible. They have to cut it off after they cook the hot dog. Natural casings, they can leave on.

Q You don't see this?

A No, you never get it. You can't chew it.

Q It's like an extrusion really?

A It's an extruded tube. But they have to cut it off after the hot dog is all cooked. But it's very successful. All the hot dogs today are.... Swift, at that time, were making ten millions pounds of hot dogs a day, and they had turned this down.

Q Who was that?

A I don't know.

Q Who did he take it to? Did he take it to Armour across the street?

A I don't know how they formed this present company -- Visking -- which had a monopoly for several years. Anyway, Swift didn't let me out of there that first day until I signed a letter of intent. Then we developed a contract, and they took an option under my patent. I agreed to work with them twenty-five percent of my time showing them how to spin the fiber and hoping their chemists could go on and develop final products.

Q Now, obviously, they're thinking of a subsidiary line of vegetable imitation meat products that would compliment their natural meat products.

A It was in conflict. That's what finally stopped it.

Q Dr. John Harvey Kellogg is doing this out in Battle Creek at this time?

A Not spun fiber.

Q No, but he's doing soy...?

A He made soy patties.

Q Some kind of soyloins, they called them; soyburgers. But that's not what you're doing?

A No. That didn't have the fiber structure that meat has.

Q You were actually to simulate the fiber structure of a piece of steak?

A That's right.

Q It wasn't mushy?

A No, no. You could make it chewy. In the research contract I agreed to give them twenty-five percent of my time.

Q You're still a free-lance consultant?

A At Swift, yes. But I wasn't on a payroll. Then I contacted the Unilever people in England.

Q And who are they?

A They own Lever Brothers here and Lipton Soup.

Q Soaps and soups?

A They're next to General Motors in size worldwide.

Q But they have a lot of consumer products?

A Everything. They're very large. They took a license under my patent -- my edible fiber.

Q They shared it with Swift?

A They wanted the foreign rights. Swift had U.S., Canada and Mexico.

Q You had signed those away in your letter of intent?

A They had the option. Unilever took the rest of the world. I was filing patents like mad. It costs money. Unilever finally agreed to pay for the patent costs because they figured it was so important that....

Q What were they going to do?

A They wanted to do it out of peanut protein.

Q There had been some work. There was Dr. Carver and others, who was another Ford favorite, in peanut utility, but this probably mushroomed after he died and after the war.

A Yes. Unilever had taken a contract from -- I don't know what government, whether it was English or what -- but to go down to Africa and manage a million acres to produce peanuts. They call them ground nuts.

Q Where at?

A It's on the West Coast somewhere. They grow a lot of peanuts down there even now.

Q The climate is conducive?

A Yeah, but they don't know how to do it. Their technology is terrible. So Unilever agreed to manage that, so they wanted to find outlets for peanut products, too. They took a license from me, and I agreed to spend 25 percent of my time over there, and we built a pilot plant to spin fiber from peanuts over there.

Q Unilever is footing the whole bill plus your consulting costs?

A Swift was paying royalties, too.

Q They got in on the peanut process, too?

A Yeah. Unilever didn't confine theirs to peanut, but that was what their intent was. They left it open. They could use any protein they wanted, but peanut was where their commitment was. So for three years, I spent one quarter of my time over in England.

Q Working with Unilever?

A Working with Unilever.

Q Their research arm?

A Yes.

Q Did you enjoy that experience?

A Very much. They're wonderful people.

Then I came back, and General Foods took an option, and they didn't confine it to any protein, but it was subservient to Swift's license.

Q They had to share that?

A Yeah. Then Nabisco took a license from me.

Q Are you getting royalties all this time?

A General Foods made a yearly payment.

Q But, I mean, from Unilever and Swift?

A Oh, yeah.

Q You were getting patent royalties?

A Yes. They were each paying twenty thousand a year. That's nothing for them.

Q That's not your consultant fee?

A That's licensing fees.

Q But you are getting consulting fees as well?

A Yes. Mostly expenses, really. Then General Mills took a license,

and then finally Ralston Purina took all remaining rights, and I ended up with Ralston Purina.

Q General Mills is sharing with Swift?

A Swift dropped their interest between their meat people and their research lab. At that time, there was the meat farmers -- livestock farmers -- were losing money, and they were mad as hell at Washington, and there was actually a march on Washington.

Q You mean by the farm livestock producers?

A Yes. Some association they had.

Q I can't imagine that there was a large proportion of Swift's business being taken away from them? Had it grown?

A No. But that's what their animal relations department -- they said if word ever gets out that you are working on a synthetic meat, you just wipe us out.

Q They were marketing it under another name?

A No, they were still in the laboratory.

Q It was still in the research stage?

A Yes. They had developed several products.

Q What kind?

A Deviled ham was the outstanding one I can think of. They had a lot of visitors going through their meat plant in the old stockyards, and they'd give them snacks up in their foyer, and they tested out their synthetic deviled ham against their real deviled ham, and we'd win every time.

Q Because of flavor, texture...?

A Flavor, and we controlled the salt better and all that stuff. And they had a couple other products which were....

Q Do you remember what they were?

A Bacon was one.

Q You could make an imitation bacon that was better than the original?

A I won't say it was better, but it was acceptable. And ham was always quite easy to do, because the smoke dominates ham.

Q Smoke and a little salt?

A And cloves.

Q You don't always get the taste of cloves in baked ham? Not everybody uses it?

A There's a lot of spices you can use in ham. But their animal people went out, and so they decided to drop their option. That opened up the U.S., Canada and Mexico to new licensees.

Q They dropped your option?

A Swift did. So then I went to General Mills, and they took it up. They took a lot.

Q For what kind of products?

A They developed a successful product called Bacos.

Q Imitation bacon bits.

A That's right. That's made out of my patent.

Q Are you still getting royalties from that?

A No. The patent ran out in '71.

Q It wasn't renewable?

A No. You can't renew a patent.

Q Patent law. You can only go how long?

A Seventeen.

Q So all these years you've been getting royalties, at least up to '71, on Bacos, which every salad bar in the universe uses.

A I forgot. Worthington Foods also took a license.

Q Who are they?

A They are this outfit in Columbus, Ohio, that are Seventh Day Adventist people who never eat meat, and they produce a line of products for this market.

Q Do you know that's why Dr. John Harvey Kellogg developed [his vegetarian product line] because the Sanitarium was controlled by the Seventh Day Adventists?

A But, anyway, they got products on the market right away. I don't think they were very good, but their market wasn't very fussy.

Q Did you assist them in getting it started?

A Yes. I set up a spinning plant, and reproduced fiber, and then they put that fiber into their products and got it on the market. They were paying royalties, too.

And Purina....

Q Set the stage for Ralston Purina. They're a huge St. Louis cereal conglomerate and also have an animal feed line.

A They dominate the animal feed market -- pet food market.

Q Cereal is a sideline for them?

A Yes, it's rather small.

Q I remember eating hot Ralston when I was a kid.

A Their Wheat Chex, and Bran Chex, and Corn Chex are very good sellers, and they do a lot of brand manufacturing for other people. For instance, they made Kroger's corn flakes and that kind of stuff. But

they were getting into the protein. They had bought Procter & Gamble's protein plant in Louisville, which was industrial protein for paper coating.

Q Why had Procter & Gamble given it up?

A I don't know.

Q What year was this?

A 1956-1958 in that area. But Purina had bought that plant and decided that they also wanted to get into edible protein.

Q They'd been watching your work?

A Apparently. But I went over to Purina with no appointment or anything, just out of a clear sky, and explained to them what I was trying to sell.

Q Had you heard of their interest?

A Yeah. I'd heard of it. At Worthington Foods, because Worthington wanted to find the source of edible protein, but they were too small to make it themselves. I went over to the Louisville plant to see if they would produce some protein according to our specifications. The manager there said, "We're not producing that right now, but I think you ought to talk to our St. Louis people." He set it up for me, so they took a license for all remaining rights.

Q Which were?

A Which were practically everything.

Q The Western Hemisphere?

A Yes.

Q Unilever is still...?

A Unilever finally gave up on it.

Q Why?

A Their peanut just didn't work out. They finally dropped out.

Q So they dropped the option?

A Yes. They couldn't get the soybeans over there economically.

Q Why?

A They don't grow.

Q In North Africa?

A In England or wherever.

Q By this time they dropped the option, so you have worldwide rights available for General Mills?

A Yes. And Purina. I consulted with Purina then, and Worthington Foods, and Nabisco. I was consulting with all of these for awhile. National Biscuit was interested in their product Milk Bone. They wanted to make casein fibers to put into dog food. So their field was very limited. So I went over and set up a plant for them.

Q Where was the plant?

A This was at the Fairmont, New Jersey, research lab. They had a big pilot plant. But then when I went to Purina....

Q What else did you do for Nabisco? That was it?

A Yes, that's all.

Q None of the consumer products?

A No. It turned out that casein fiber was not economical to put in a dog food. It would be all right for human food.

Q Why?

A It's too expensive. You have to use milk protein.

Q This is a low-cost product?

A Milk Bone is.

Q The dogs aren't very discerning? They just want something to exercise their teeth and gums?

A Yes. That's why they wanted to put fiber in it to give it that. But, anyway, Purina took the rest and asked me to come over and consult with them, which I did for two years, and then they asked me to go on the payroll, and I did.

Q What were you doing for them as a consultant?

A Showed them how to spin fiber and how to make the protein edible.

Q What products did they utilize it in?

A They have a very successful business now. They've got plants all over for producing edible protein in bulk.

Q Did they incorporate it in any of their consumer products?

A No.

Q Or in their animal feed?

A They, again, have a conflict -- you have be very careful about it. Their big market is pet food people. But they built these....

Q What was the conflict? Was it ethical or commercial?

A Commercial. Their animal feed, which is a six hundred million dollar a year business, is made out of grain products. If they were going to produce, let's say, synthetic ham meat, they would be in competition with animal producers. They were very touchy about these markets.

They've been very successful in their soy protein. They've got a plant now in Belgium, three in this country, and they're building one in Russia, and they're going to go all over the world. It's the cheapest crude source of protein going, and the poor countries who are not the

sophisticated appetite people like we are, are using it. They're mixing it in with other products. They can't make enough of it right now. That's why it's a good stock.

Q This is far beyond the soybean curd we're getting in tofu. This is far more sophisticated?

A Oh, sure.

Q And they're mixing it with all sorts -- they're providing the protein content to a lot of low-cost, edible foodstuffs?

A Yeah. It goes into hot dogs, and sausages, and mixed meat. The meat industry loves it.

Q It's an extender, right?

A That's right.

Q And a source of protein?

A And it improves the product.

Q Improves the consistency of the product?

A Yes. And that's going more and more in the baking industry -- in breads and that sort of thing.

Q Had you envisioned this explosion?

A Oh, yes. We had a long time ago.

Q We? Who?

A Wherever I worked. I worked in so many research labs.

Q You're in at the ground floor at Ralston Purina, and you have a reasonably lucrative consulting contract, plus you're getting royalties from -- did General Mills stay on?

A Yeah, until the patent ran out. Their royalties were growing.

Q Ralston, too?

A Yes.

Q But you're there on a three-month consulting project, and then Ralston Purina put you on the payroll?

A They asked me to come on the payroll?

Q And did you accept?

A Yes.

Q How many years did that...?

A Nine and a half. I retired in '71.

Q When the patent ran out?

A Yes, but that was incidental.

Q That was not the reason?

A No.

Q You'd felt you had enough? You had a very busy life?

A We'd gotten remarried, and we have a beautiful boat. We decided to enjoy it.

Q Prior to '71 -- the ten years before '71 -- you're getting patent royalties from Purina...?

A And Worthington and General Mills.

Q Worthington continues? They're doing the vegetarian thing?

A That's right.

Q Had they cornered that market?

A Oh, yeah.

Q I can remember when I was a kid seeing the Battle Creek vegetarian products, and later, in a very reduced form, still selling?

A Oh, yeah. They're selling them.

Q And I'm sure there are other companies that do it, too. But they have the lock on the...?

A On the sophisticated products.

Q Like the vegetarian?

A Yes. Because they're the only one using fiber.

Q General Mills and Ralston Purina have the worldwide rights to your edible soybean process?

A Of course, now there are no more rights. There's no more patent.

Q But you were getting patent royalties from them up through 1971?

A Right. Very nice.

Q You enjoyed your work?

A Oh, yes.

Q They enjoyed having your expertise and your input?

A It really was quite an unusual story because I would go from research lab to another and be part of their basic crew and have access to everything.

Q Did Worthington put you on the payroll?

A No. Just a consulting fee.

Q And General Mills was a consulting fee?

A Right.

Q But you were on the regular research payroll of Ralston Purina?

A Yes. It's very unusual for a person to be able to go in and out of competing research labs and actually work in them.

Q General Mills had no commercial conflict?

A No.

Q Because they were dealing in meat?

A They went all out on that Bacos product. It's been very successful. We made a lot of money on it.

Q Is it still marketed?

A Yes. There's a cheaper formula now made from extruded soy meal, which is not nearly as good, but it's cheaper.

Q I've only seen it at salad bars?

A Yes. That's where it went over real big.

Q Spice companies?

A McCormick has them.

Q And who else? Spice Islands?

A Yes, Spice Island.

Q If Spice Island has marketed a Baco type, it would be on license from Ralston Purina?

A It might be

Q Or would they do their own?

A There's a big patent fight going on now between Purina and a farm cooperative who is infringing on one of the patents, which is in my name, but it's assigned to Purina.

Q Did you have to sign over many of those patents?

A None of my own, but while I was working in another research lab and they were paying costs, they got the patent. But I maintained the....

Q You developed the Baco concept under their direction?

A Right, and they paid a royalty on that. This big patent suit that I testified in just a little over a year ago, Purina won it. Amounted to eight million dollars. It was pretty big.

Q A farm product conglomerate was trying to...?

A Farm Mor Company, it's a big outfit.

Q They were trying to set up a competing...?

A They did. They were producing tons and tons of it, in spite of the fact that we accused them of infringing, and they went ahead anyway, so there was quite a big penalty. I haven't heard the details of the settlement.

Q Did you give expert witness testimoney?

A Yes, that's what they called me.

Q Here you are, it's been fifteen years since the royalties stopped, what are you doing in the interim since you've been retired?

A Traveling.

Q But, I mean, in terms of the industry.

A I worked as a consultant for Worthington for awhile.

Q Are they still in business?

A Oh, yes. They're very active. Then Miles Laboratory bought them.

Q Where are they based?

A Elkhart, Indiana. They're a real old company, and they wanted....

Q An old line pharmaceutical house.

A They wanted to get into soy protein, apparently.

Q To diversify?

A Yes. They asked me to consult with Worthington, using Worthington as a base. When I retired from Purina in '71, then I went as a consultant for Miles, but located at Worthington.

Q How many years did that last?

A I was there about six years.

Q Was it enjoyable?

A Very much. They let me phase it out. I'd signed a contract for nine months for the first year, six months, four, three and then one.

Q What products did you and Miles come up with in that period -- new products?

A Just refinement of Worthington products. They bought Worthington, and they were refining it. They never quite knew what they wanted to do with it, actually. They weren't sure that they should....

Q The vegetarian market was expanding, wasn't it?

A Yeah. They wanted to expand that. That's where they finally did go was to expand it under the Worthington label. Then the German company -- Bayer Aspirin -- came over from Germany and bought Miles, and they terminated all the work on soybean.

Q Why?

A I don't know. They actively sold off Worthington. Worthington bought its own plant back again.

Q Are they back in business?

A Oh, yes, they're in business. They never....

Q Bayer Aspirin came over as a foreign conglomerate, bought Miles Laboratory, which had bought Worthington....

A And then there was a complete change of management.

Q Right. Kicked out the old Miles Laboratory executive level, brought in their own people....

A And decided to get out of the protein business.

Q Why?

A They're so involved in medicine, chemically.

Q So was Miles?

A Yeah, but not to that extent. Alka Selzer, which is their big product, Bayer was pushing that, of course. Miles was a very profitable company.

Q Are you still on a consultantship?

A No. When my eyes really started getting bad, about four or five years ago, I quit.

Q Worthington, after they reconstituted the company, went into business again as an independent company?

A Yes, but they decided to restrict their marketing to their vegetarian or Seventh Day Adventist groups. Miles tried for awhile under the name of Morningstar Farm Products. They pushed that pretty good, and as long as they were on T.V. and pushing it, it sold real well. But the minute they stopped advertising or pushing it, the sales dropped.

Q There are other forms of advertising: print, radio, magazines?

A They tried most everything.

Q But it was T.V. that really got them the market?

A Yes. And their products weren't good enough. I never was happy with the quality.

Q Why?

A I don't know. They always had to make some....

Q Cutting corners?

A Cutting corners, and when you go from laboratory to production, in the laboratory you can make a delicious ham, but....

Q You were not asked to follow the products through after it got out of the laboratory? In other words, you weren't asked to be a quality-control man?

A No.

Q So you couldn't affect that?

A They had their own committee. They'd decide on whether they

wanted this formula or that formula in the product or whatever, and they had a committee set up for that.

Q So they cut corners, and, in effect, adulterated their product?

A Yes. It just never quite took off. If they spent $50,000 a month, say in Florida, on advertising, they could sell that much and break even, but they weren't making big money.

Q Are they still in business?

A Worthington?

Q Worthington.

A Oh, yeah. They're growing.

Q Are they the only company doing synthetic products?

A And fiber work, yes.

Q The only one?

A Yes, in this country. Now since the patents ran out, there are two companies in Holland now, and there's one in Japan that I know of, and, I think, one in Australia, and there probably are more that I don't know about, because they don't have to tell me what they're doing.

Q Do you follow the technical literature, the trade literature.

A Yes.

Q So you know what's happening?

A Pretty well.

Q I'm aghast that no one's ever looked into this aspect of your career. Everybody assumed it stopped after the plastic car.

A That's when it really just got started.

Q You went on to incredible vistas. Is there anyone else like you in this country? Obviously, very few people came up through the same route

you did. Obviously, there are scientists who are working -- trained -- in edible plastic technology?

A I think so, yes.

Q Are there schools -- academic programs...?

A Yes. Michigan State has a very strong food technology department, and they keep following it. Amherst, Massachusetts....

Q The University of Massachusetts [is in Amherst].

A Yes. It isn't Amherst College. There's another one out there. They've got a professor who is highly interested in it. MIT keeps an eye on it. Of course, they have a pretty good flavor lab set up at MIT.

Q And that is, of course, the essence of much of it?

A They can taste test new products and tell you what's wrong with them or what should be done. But I'm sure there are a lot of private research labs like, for instance, General Foods is quite active in it, and Procter & Gamble is a comer.

Q Jumping back into it?

A They never really got into it. They sold off their industrial protein, but they've come out with a lot of new patents on protein structures.

Q What commercial application have you seen of that activity?

A Nothing. Procter & Gamble hasn't done anything commercially.

Q There are no new consumer products that they've come up with?

A No. The only thing you can find out about them is through their patent literature.

Q They're very secretive?

A Oh, yeah. And most of the big companies are now. I don't think I could ever get a setup like I had before where I can work three months in one company and then go right to their competitor.

Q You should try to interest someone in writing this [material] up because your career is unique. A lot of people claim that, but it's true with you?

A I'm going to, and it is. One thing I'm always sorry that Henry Ford wasn't around at this stage.

Q He would have loved it.

A Oh, I should say! I even went to the Ford Foundation in New York to see if....

Q When?

A This must have been about ten or twelve years ago to see if they would be interested in a worldwide, humanitarian type of product, because the African people were starving -- and in Central America. I thought that they would be a natural for them to set up a research project in Africa -- I didn't care where -- and I was willing to help all I could.

Q Donate your time?

A But it's too political now. At least I couldn't get any interest aroused in them.

Q The relief organizations that are assisting in famine areas....

A Ethiopia.

Q Are obviously using edible protein. It's easily transportable and the most easily ingested, and it's, of course, a rich building block -- substances. So who is producing that for this effort, which company?

A I really don't know.

Q Of course, there are all kinds of them now. Seems like everybody's in it. But isn't that the basic form of sustenance for famine-ridden countries?

A That's right. It could easily be compounded right on the spot,

you might say, into edible end products for these poor people that are starving from lack of protein.

Q In other words, the soybean is not necessarily the savior of mankind?

A No. It just happens to be the most economical right at the moment, but there are literally -- any seed is a potential source of protein. See, the soybean is a seed; so is a peanut and so forth.

Q The potential is really unlimited?

A Yes.

Q You really don't have to have starving people, right?

A That's right. And Purina is probably on the right track in building their basic edible protein plants like they are. All the time, they're improving the flavor. It's getting better all the time.

Q It had always been a drawback. People starving will eat it, but they don't like it?

A That's right. They'd rather starve, actually. At the end of World War II in Italy when they were so short of food, the government had hundreds of tons of soy flour, and people wouldn't eat it. They starved! They wouldn't eat it.

Q Why?

A It tasted terrible.

Q You still hadn't refined your taste technology?

A It just rotted there on the docks.

Q Yet they were starving?

A Yes.

Q They could have made bread?

A There's activity in India, too. I forgot about that.

Q What kind of activity?

A I wouldn't doubt that there's some protein plants being built by the English government. They grow a lot of peanuts over there, too.

Q In India?

A Yes.

Q Perfect climate for them?

A Yes.

Q It's strange that Unilever backed out. Did you ever find out why?

A Well, the peanut.

Q They couldn't get the peanut growing in North Africa, but could they have gotten it to grow somewhere?

A They had this contract, which, I think, was a chain around their neck.

Q What contract?

A With the English government to manage this big peanut protein deal in Africa for them -- the British government. But they would have to bring the peanut down about a hundred miles to the port, and this was all done on native bare backs. I mean, haul a hundred pound bag. What turned out, and this ruined their plan, they would ship the stuff up to Port Sunlight near Liverpool where they had this big plant. The natives would start out with a bag half full of peanuts, and then as they'd get down toward the docks, they'd fill them with rocks and anything else that was heavy -- dead animals and that kind of stuff -- so the stuff arriving up at Port Sunlight, half of it was so putrid by that time, that it just....

Q They would do it in order to increase the weight?

A They were expected to deliver a hundred pounds in a bag, and they'd have to march about a hundred miles, as I was told.

Q Peanuts were a lot lighter than rocks and dead animals?

A Yes. They would start out with only about half as many as they should. They told me it was a hundred miles sometimes.

Q It's their fault for having this antiquated transportation system?

A They're still working on it.

Q What's the most popular source of edible protein that companies are using.

A Soy.

Q That's the best?

A It's the most economical.

Q Peanuts are too expensive?

A No, they could in this country. The peanut farmer is pretty good, but peanuts are a little expensive yet compared to soy.

Q I once visited the Central Soya plant in Fort Wayne. How did they figure into this whole scheme?

A Central Soya bought the Archer-Daniels protein plant which was located in Chicago.

Q That was a large bulk protein processing plant?

A Right.

Q Largely from soybeans?

A All from soybean. But it was a solvent extraction plant, rather than an expeller.

Q They threw the sludge away?

A Yes. They were trying to make protein for paper coating.

Q These were industrial uses?

A Yes. And Central Soya bought it, because they were using the oil in their paints. They didn't know what to do with the protein, but they wanted it, anyway. The plant blew up on them, but they did rebuild. That's the one that....

Q The one in which the sparks ignited the dust?

A Yes. But they remained in the soy protein business all these years -- inedible protein.

Q So Central Soya is not edible protein?

A It is now, but it wasn't. It doesn't amount to much even now, but they do produce it.

Q I had the idea that they were supplying people like Kellogg. Do you remember the product called Corn Soya? I thought Central Soya was supplying them with the soya product.

A I don't know about that. I remember the product.

Q I don't think they do it anymore.

A They don't make it. They learned they couldn't sell soy.

Q Even though they put corn with it, and salt and sugar?

A It was a pretty good product. I liked it. We went through the plant once, and they served it to us afterwards. I was still working at Ford then.

Q You went through as a visitor or as a visiting scientist?

A I asked to go through the plant, and they said, "Sure. Come on up, and we'll take you through."

Q This was a fairly pioneering effort in soy cereal?

A Yeah. They had a very active research department.

Q Did they? In Battle Creek?

A Yes.

Q I was growing up at that time. We used to go through it all the time to get those free cereals, and I'm sure I ate Corn Soya. Did you know that Garry Moore, who was a very popular entertainer for many years, was sponsored, at one point, by Kellogg's Corn Soya, and he had a little jingle that he used to say, "Corn Soya, oh boya, how I enjoya, in the foya." I never forgot that.

A They had a hard time marketing it. It wasn't a bad product, really.

Q So Central Soya was really largely in the industrial application of soy?

A When I first went to Swift, we approached Central Soya to see if they would produce an edible protein suitable for our purposes, and they agreed to try to do that. I gave them my thoughts on how to do it. They went into the business and have been in it ever since. They have an active edible protein plant.

Q What products are they producing?

A A filler for the meat.

Q It's bulk? They're not marketing something?

A No end product, no.

Q What companies are marketing recognizable brands that use edible soy protein?

A There's thousands of small, localized meat companies. Every city has a lot of them. That's where the big market is.

Q Meat processing companies?

A Yes. Oscar Mayer, for instance, would hesitate to dilute anything in their hot dogs. They might put out a meatloaf or something, but they would never touch their hot dog formula.

Q So they don't use soy extenders?

A Not very much. They have some obscure products that do, but nothing that's a well-known brand name. Swift wouldn't do it either for their hot dogs, but they seriously considered something like deviled ham. They could do that.

Q There is a deviled ham on the market. The only one that makes it is...?

A Underwood.

Q What is the composition of their deviled ham?

A It's all real ham ground up.

Q They don't use soy?

A This is why Swift got into that. It just irked the dickens out of them that this little dinky Underwood company dominated the deviled ham market. No matter what Swift did, they couldn't touch their sales, and it just irked the dickens out of them.

Q I tried that. It's salty.

A It is. They load it up with salt and fat and everything. So we could make a superior product with the fiber.

Q And it was more healthy?

A Yes. But they had that meat conflict.

Q It sounds like Swift was a a bit timid. They'd lost the sausage casing invention that they could have had, probably, for a song.

A They were so big, and, of course, so set in their ways, that they....

Q Inflexible? Old line company?

A Yes.

Q They'd done it like their German great-grandfathers had done in Germany?

A That's right.

Q Incredible. And then they passed up the deviled ham market?

A They were seriously considering marketing that when the other side won out -- animal relations groups that said, "Don't touch it. Get it the hell out of the lab."

Q Would it have been unethical for them to market it without saying -- was the Food & Drug Administration so strong that they couldn't have -- they would have a soy imitation meat product?

A Yes.

Q And they would have to list the ingredients?

A Yes. We still don't know how to market these products, and we're probably fifty years ahead of the market. But as the population growth continues, it's got to come.

Q You've got the taste problem licked?

A It's getting better all the time. I'm not sure you'd say it's licked.

Q MIT runs a taste laboratory?

A Yes. They only evaluate new products for industry. For a $15,000 fee, they'll....

Q You mean research?

A Yes.

Q They'll get a panel of tasters together, and they'll rate them?

A That's right. And they can even go farther than that. They'll say they need certain....

Q Shadings?

A Yes.

Q What kind of products will they taste test for market research?

A I knew some company that used them all the time. I've forgotten who it was right now.

Q Someone who's in the imitation food [business]?

A Yes. I can't recall. When I was first trying to sell my patent, I went to MIT, because I knew they were active in foods, so I took a prototype -- pork chop or something -- and they actually tasted it. They said, "Your texture is all right, but your flavor is no good."

Q You tried to smoke...?

A Yes.

Q This is a cooked pork chop that you're simulating?

A It was white -- cooked color.

Q It had kind of a gray color?

A Yes.

Q When I was a kid in Battle Creek, I used to see these -- they called it the Battle Creek Food Company, and it was a spinoff from the old Sanitarium. Dr. John Harvey Kellogg fed that stuff to his patients, because he was a vegetarian. The Seventh Day Adventists were, too.

A Worthington finally bought them.

Q Did they buy out Battle Creek Food?

A Yes.

Q What year?

A About '58 or so, somewhere in that area.

Q They lasted that long? And I can remember going up to where the Sanitarium was, and I can remember the marketing arm of this company would have their products displayed in a walk-by window. They would have Soyloin, they called it. I think they patented that name. They would have soy burgers, they would have soy hot dogs, they would have soy filets (a simulated steak), and they would have all kinds of [simulated meat products]. I used to say to myself, who eats this stuff? I'd never been a vegetarian. I never even wanted to be a vegetarian, although I eat a lot of vegetables now that I'm getting to the point where I need a lot of fiber, but at that time I couldn't imagine anyone eating an imitation steak.

A That was all based on wheat gluten.

Q That was their base?

A Yes. And also it was Worthington's original base until they got into fiber.

Q They called it Soyloin?

A Yes.

Q That was a catchy phrase, but it was all wheat gluten?

A Yes.

Q And Worthington, too?

A Worthington was at first until they got into fiber. And they bought Battle Creek and retained the name on some of their products. They eliminated some of the others. They had a lady research director up there. I've forgotten her name.

Q Where was Worthington, again?

A Columbus, Ohio -- Worthington, Ohio, actually. And they brought this lady, and she worked in their laboratory at Worthington until she retired. She was quite elderly.

Q She was a research chemist?

A She was for Battle Creek.

Q Oh, they brought her down from Battle Creek?

A Yes. I visited her up there in her laboratory a couple of times.

Q In Battle Creek?

A Yes. It was in an old factory building.

Q Have you any last words?

A Yes. One thing seems to me that should be stressed is the soybean has turned out to be our number two cash crop and also our second largest earner of foreign trade money. That really started from Ford. When we first started in '31, hardly anybody ever heard of the soybean, and Henry Ford's penchant for publicity publicized the soybean. I don't think we added particularly important stuff, technically, to the soybean industry, but he certainly made it popular and made people become aware of it. Today, it's so darned important.

Q Will he be remembered as the "Father of the Soybean?" For the commercial utilization?

A That's right. And I always thought that it would be nice if they would rebuild the [Soybean] laboratory [in Greenfield Village] or restore it like it was when we were doing that soybean work and give it the real credit that it deserves, instead of treating it like -- last time I saw it, it was a receiving or storage and shipping....

Q Shipping and Receiving. Now it's going to be the ticket office for the railroad which has been moved over to accommodate the Firestone Farm.

A They're a missing a bet. If they're trying to enhance Ford's reputation, that would be one way to do it. I think when he died, the rest of the family wanted no part of any of his pet projects.

Q Ultimately, that's what happened.

A Wiped them out.

Q They completely eradicated the old Ford company. It was the new Ford company, and all of his interests, and hobbies and special enthusiasms were....

A Gone.

Q That's too bad.

A Yes, it is.

Q Because he was, really, the benefactor of the farmer in many ways. The tractor, of course. The Model T was a utilitarian vehicle and most attractive to farmers -- most used by them. His feeling, as you so eloquently mentioned, was for the welfare of the farmer. I agree with you, wholeheartedly, that something should be done to memorialize his great interest and enthusiasm in converting the soybean into the miracle substance it is today.

A There was an article, "The Miracle Bean," or something like that. But it's coming. It seems to me, he should be getting the credit.

Q Maybe we can do something about it?

A I hope so.

Q Mr. Boyer, I want to go back to a subject which we've barely touched on: the chemurgic movement. It may not have been called that --

the utilization of surplus farm products processed in some way to utilize whatever usable substances that could be extracted from them. Where did that get its start, outside of the impetus that you and Mr. Ford gave it?

A One example -- it's not the only one, but one I remember -- was the Quaker Oats Company developed a process for producing furfural from....

Q What's that?

A It's a chemical like phenol. It came from oat hulls.

Q Which were usually discarded?

A Right. It was the first publicized development of a chemurgic nature, and it was strictly a chemurgic development.

Q A chemical compound coming from...?

A From a waste agricultural source.

Q That was, what, in the late 'Twenties, or early 'Thirties?

A I first heard of it in the late 'Twenties.

Q That was a rather sensational development?

A Yes, it was, because plastics were just beginning to be talked about and were getting well known. We (Quaker Oats) were hoping that furfural would replace phenol for a lot of these plastic....

Q Become the mainstay?

A Yes.

Q And that's distilled from coal tar?

A That's one of them. Of course, they can make it synthetic now, too. That's the first case that I am aware of where it was a good example of it.

Q Were there others that followed them?

A There probably were some that I'm not aware of. Of course, the soybean took all our time and efforts, and it was a good starting point for chemurgic products.

Q The fact that the hull was discarded on most grain products -- were there other grain hulls that were utilized in that way?

A We tried it, of course, on soy hulls and didn't get a yield. Corn cobs was one. They never became commercially....

Q What sort of fluids or liquids did you get from corn hulls?

A They were trying to get furfural again.

Q So the chemurgic movement is beginning to coalesce in the early 'Thirties, and then you and Mr. Ford come along. What happened then?

A Well, he....

Q I noticed the makeup of the council is largely chemists. Were you not sponsored by the American Chemical Society

A No. It was a different organization.

Q But it was the public relations arm of the chemical industry?

A Yes. The Chemical Foundation. I'm trying to think of the man that headed it up, because I knew him quite well. When we had our first convention there in Dearborn, he was very prominent.

Q How did this idea of a chemurgic council take form in the early 'Thirties?

A I think it was The Chemical Foundation, and there was a magazine published in Philadelphia called Country Gentleman, and they got behind the idea and pushed it. The president of that one spoke at our meeting in Dearborn.

Q But, let's go back. The movement is gathering steam. Was there someone like Mr. Hale who came along and...?

A Yes. He played a prominent part.

Q He was a chemist with Dow?

A Dow Chemical, yes.

Q In Midland [Michigan]. What was his full name, again?

A William J. Hale.

Q Does he approach you and Mr. Ford?

A Yes. I think he did that, and he had a meeting with Mr. Ford, and he sold Mr. Ford, again, on the potential of soybean.

Q So Hale was the salesman?

A Yeah. That's the way he reached us in Dearborn. I visited him in Midland a couple of times.

Q Did you have a complementary interest?

A Yes. He followed our work with soy, because I don't think Dow was doing anything on that line. He was very much interested, himself, in the work and followed it.

Q He suggested to Mr. Ford that you set up a national...?

A He said, "You're on the right track. Keep going," and that kind of stuff.

Q So who really got the first chemurgic council together?

A I would think the head of The Chemical Foundation, and how we got it to Dearborn -- The Dearborn Inn had just been built.

Q In '31?

A Yes. Somehow or another that got tied in, and that's why they decided to hold the conference there.

Q Were you asked to handle the organization?

A Yeah. Not the program, necessarily, but I had to make sure all the food was going to be all right.

Q Who set up the program and invited the participants and set the subjects of the papers?

A I believe that it was the editor of this magazine in Philadelphia.

Q Country Gentleman?

A I think that was the name of the magazine. He was very prominent in the chemurgic field. Their names are probably in the record somewhere.

Q In the Proceedings?

A The man from the chemical foundation. He was a real promoter, too.

Q So you have these marvelous papers given which largely dealt with -- at one point it seemed to me it dealt with the extraction of combustible fuels from surplus vegetables.

A Alcohol was, of course, the....

Q Power alcohol.

A That was the big deal in those days. George Granger Brown from the University of Michigan was on the program. He was a very well known chemical engineer. He's head of the engineering department up there.

Q But he was also enthusiastic for power alcohol?

A Yes.

Q That meant simply processing waste vegetables to extract a combustible alcohol?

A Yes.

Q That was one prominent feature, but what other subjects were...?

A Other than the soybean, I don't think there was anything that was outstanding. I believe Carver was in on this.

Q I wanted to ask you about that. Supposedly, George Washington Carver was invited by Mr. Ford to attend the first conference.

A I think so. I think he was on the program.

Q He's not on the printed program, but he may have been an added starter after the....

A He did speak in Detroit at an ACS meeting.

Q Yes he did. But Mr. Ford said, "Why don't you come out. I'll get you a room at the Dearborn Inn and come to our...." Were the sessions held at the Dearborn Inn physically?

A Some of them were.

Q Where were the others held?

A I don't know of any place else.

Q It must have been at the Dearborn Inn.

A The ballroom wasn't all that big.

Q Had you used the theater in the Henry Ford Museum?

A No.

Q Were they well attended? Do you remember how many people came?

A Three hundred sticks in my mind. I'm not sure.

Q They were chemists, scientists, chemical executives, interested people?

A Yes. There were enough names there that it attracted research directors from all types of industry.

Q Were the publication Proceedings financed by Mr. Henry Ford?

A I wouldn't doubt that. I really don't know that.

Q Do you think he allowed them to use the premises of the Dearborn Inn...?

A Free, maybe. I wasn't in on any of that.

Q That was one big one. There was a second one in '36 as well.

A Where?

Q There were two chemurgic council meetings in Dearborn. We have the Proceedings.

A I don't remember.

Q And the second year was an extension of the first -- still a lot involved with power alcohol. At least, that's high in everybody's mind.

A That was, of course, the big market.

Q As you mentioned earlier, the tremendous surplus generated by the Depression and by the Roosevelt policies of subsidizing farm products, generated a mountain of surplus vegetables which people felt had to be utilized or they'd just let rot or used as fertilizer or sileage. So there was a second one, and there was also a third one -- a much smaller conference. We have the Proceedings, and they're bound in the same way.

A In Dearborn?

Q No. The same distinctive orange binding and the same printing, but it was in Florida. It may have been in Gainsville at the University of Florida. William J. Hale wrote two popular books on the chemurgic movement. One was called Farmward March. Have you ever seen that one?

A That starts to ring a bell.

Q And another one with another euphoric title, which escapes me at the moment. And I suspect that they were rather well received. He sent signed copies to Mr. Ford, which we have, and it seems like it was a very enthusiastic public relations gung ho approach which he may have popularized. Did the chemurgic movement, as a movement, die a bit during the end of the 'Thirties.

A Yes. The on-coming war took over.

Q After the war it went on into more sophisticated channels?

A Yes.

Q Farm subsidies have always been a problem in the country, because most, as you know better than I, administrations do subsidize farmers. I guess the Reagan administration -- the second administration -- is the first to cut subsidies?

A Yes. It's going to be a touchy subject.

Q Is there anything that you would like to say further about Mr. Ford's interest and support of this incredible saga?

A I was fortunate in being so close to him, and being like a protege or something.

Q Like a son?

A We did spend a lot of time together.

Q What are your personal impressions of Mr. Ford?

A When you were on the good side of him, it was great.

Q He couldn't do enough for you?

A Some of the people at the Rouge Plant he didn't like lived in the fear that they'd run into him someday.

Q He'd say, "You're still here?"

A Yes.

Q He did have this vindictive side?

A Yes. I think he got a kick out of playing one man against another. It was like when he said, "Now don't tell Charlie about our project here," and that kind of stuff. I wouldn't say that we'd call him a deep thinker. I knew William J. Cameron quite well. I used to go up to him for advice. I think Mr. Ford prob-ably wasn't as deep a thinker as

Cameron was, but he used Cameron. He knew just how to get his strong points. Of course, he was a good engineer. He was a sound engineer -- basic.

Q An intuitive engineer?

A Yes.

Q He may not have had formal training, but he had an awful lot of on-the-job training from the ground up.

A One of the other things -- I touched on Dr. Ruddiman's work -- was in our efforts to find a type of bean that would not have the bad taste. There's several varieties of green soybeans. They're green when they're ripe, and they were the ones that most of the companies tried to use for canned beans or something like that. Dr. Ruddiman did develop some pretty good tasting products out of green soybeans. So Mr. Ford said, "Let's build a canning plant." And, sure enough, we put in a complete canning plant somewhere on the Ford estate. It was on the outskirts of the Ford estate, not inside the limits. It was an old wooden building that Ford owned, and he said, "Let's put it in there." So we built a complete canning line where we blanched the green beans -- pressure cooked 'em.

Q When was that?

A It must have been in the time when Dr. Ruddiman was trying to develop food products.

Q It wasn't one of the stone buildings; it was a wooden building?

A It was a wooden building.

Q It was a large farm building?

A Yes. Mr. Ford liked to utilize what was available. And when the war threatened, we saw we were going to have to close down, and he gave

that to Michigan State University. Dr. John Hannah was President. He came down [to Detroit], and Mr. [Henry] Ford made a present of the complete canning line. They could use it for teaching canning to students. It amounted to quite a lot of money in those days. That's another aspect of Mr. Ford.

Q You've had the best possible career. Most exciting.

A Yes. I was always lucky to be on the good side of him.

Editor's Note: Robert Allan Boyer, long time friend, associate and confidant of Henry Ford, Sr., passed away in November, 1989.

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