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TAPE #1
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I was born in May 1901 in a large village in northern Bohemia near a small city called Roudnice. The village was Charvatce. The small city was a center of the large agricultural implement industry, making all kinds of devices for farmers and it was a very high class industry. One is to imagine that the farm implement industries are rather imprecise and rather not on the level of other farm machinery industries, which was not the case here.

The industry produced plows and also drilling machines for seeding wheat; silage machines. These machines were immensely well designed, very well made, very accurately made and the industry itself was on a very high level. For instance, a plow factory and a steel factory which made steel and open hearth furnaces, small furnaces. But the foundry was inside white, painted white and was clean, walls were clean, and the factory already in 1910 was making castings for trucks which were made for wheels which were made hollow so that wheels were actually shells, of spokes, and rims, and hubs. A very thin, something like 1/8th of an inch and they were doing flawlessly. They were supplying these casting to many industries outside of Austria. In those days, Austria was whole of Czechoslovakia as a part of the empire and the steel industry there was on a very high level as were the rest of the industries.

The background of these (local) industries was in the history of one man, his name was Bracner. He was a blacksmith. He never ceased to be proud of having been a blacksmith. What he did was to provide a steel plow which up to that time was unknown. It was made of wood and it disintegrated in weather when left over in wintertime. And he produced such a plow, and a Jewish family financed him in order to make it possible to manufacture of this plow. And as industry grew, orders were overwhelmingly large in numbers. He became wealthy and sold it to the family which originally financed him and started a new factory for drill seeding machines which were famous all over Europe. And trainloads of them were shipped every week, Sometimes even two of them a week, to Romania, to Russia, to Hungary and Poland and so forth.

This man was so enterprising in old age, he must have been over 80 when I used to see him from a distance, that he decided that he was going to start an aircraft industry. To that end he acquired a license from Bleriot in France and two young men from the technical school whom he sent to France, learned all about aviation in those days. And they came back and they started manufacturing the Bleriot airplane in his factory warehouse in the city. That's when my father took me to see the assembly of the airplane. That was an experience which was tremendous in its educational value and in forming the direction in lifetime.

The airplane eventually flew. It landed very badly because there was no smooth place to land and it got damaged a little bit but not seriously. By this time old Bracner died and the successors did not see fit to continue this, although he was right in time because the World War was coming and the airplane industry was going to become very large all over Europe.

Then the airplane damaged, was not destroyed. But it was hung up under the roof of the warehouse. And I had a friendship with a young teenager like myself. I was one. And he and I used to go to the hangar which was a hangar, actually in those days, and sit there in that airplane and pretend we were flying because the airplane was perfectly intact actually, except small damage in the front. This had a great influence on my thinking, upon general course of being interested in aviation and also in turbines, which through my father, I learned about in already 1911, 13, 14.

The first turbine I learned about was a Youngstrom turbine in Sweden which was a contra-rotating radial turbine and all the rest of my life I was always working on contra-rotating radial flow turbines and compressors. This was the background of it. To this very day Youngstrom brothers in Sweden have been my heroes and people to look forward to. And last time we were in Sweden, this year early in April, I met the son, Ole Youngstrom, of Frederick Youngstrom. And it was quite an experience because he is just as fine a man as the two brothers must have been.

Then we moved from the city to a village outside of the city, about an hour's walking distance, which was among orchards of cherries and surrounded by forests, a very beautiful place. My father rented the castle there which was a small castle, three floors, in the empire style. And he made us move over there and we lived there while I was going to technical school in Praha.

This place in itself was very enchanting place. Not only in its surroundings but also among the people who lived there, because the place had many professional people living around. And nearby, about walking distance away on the main railroad, suddenly emerged a building. And this was in 1919, when I made a maturity examination of the Gymnasium, and I wondered what the place was. And my father told me that's going to be a tractor factory.

Having about a week of vacation behind me, I applied for a job there. I got a job as a trainee mechanic and that was an experience which I have never forgotten either.

It was a real example of free enterprise. The factory was a long building, brand-new built. In the middle was a power station which was a steam engine and a boiler; locomobile. One wing was machine tools and the other wing was an assembly hall. We were making tractors for farmers, very clumsy tractors in those days compared to what it is now, but still they worked. And the experience was tremendous.

I used to get up at five in the morning, walk an hours time, and then be to start at six. Leave work at two in the afternoon, I walked back.

Were they very advanced tractors?

No, the tractors were not really very advanced. They were on the level—they were original—but they were not technically as advanced as later-on developed. They were rather heavy and they had slow speed engine, fly wheel, and it was a boxer engine with two opposed cylinders and they were somewhat rough in running but they were a beginning. This man who financed it, he became rich from plowing the battle fields in Poland. He had tractors, plows, using for this purpose. The plow which was developed in Germany and Czechoslovakia also, which could do only plowing and couldn't do anything else. And he plowed the fields, lost many tractors by explosions of the plows hitting the grenades and shrapnels. But with this money he started a factory for tractors and I worked for nothing but I got a tremendous value of experience from it, and knowledge, and many friendships.

In fact, the employment people, employees, were very high level people there. They all had experience in engines of one kind or another, some of them in aircraft engines already. And when, after two in the afternoon I would go through the cherry orchards, I'll meet numbers of them here and there with their young ladies and they were like professors. They were mechanics. It was a very high level community.

And in Praha, my brother and I entered the technical school of high learning at a great disadvantage. Because in 1919, in the fall, upon the schools descended a mass number of people who were deprived of education during the war. And ratio was tremendous. At least ten to one compared to us. We knew instinctively that there was no future for us in progressing fast in employment later on because it would be all taken by these older people who know the world.

And that was the decision to migrate to the United States. And to prepare for it, we instinctively learned the English language beginning in 1914. And my father asked an older lady who was the originator of the kindergarten system in the city, and used to live in England, and spoke English, to teach us. And she did. We went there twice a week for lessons in the English language. We did homework also and we learned passable English by 1918 already, so that we could communicate and get across very well.

And this was a broadening of tremendous knowledge which was available suddenly. We, of course, learned German and French but these languages didn't have such a far-reaching consequence as English did. And when we came to technical school, we studied for four years and I studied mechanical engineering, electrical engineering and at the end of four years I got a scholarship from Union College in Schenectady, New York, to finish electrical engineering, which I did.

My brother went to Yale to continue mechanical engineering in the automotive industry because Yale at that time was the only school at that time, I think in the world, which had teaching of automobile and vehicle design. There was nobody else like that.

Was there a high degree of engineering in Praha?

In Praha, in Czechoslovakia generally, there was a great background, great tradition of turbine engineering. Turbines were built already since the 19th Century. They were built for small grist mills which were scattered all over the country. And the grist mill had a water turbine which accumulated water and worked only some hours of the day, not every day, all the time. And later on, in order to make up for the lack of water, they used to buy steam engines and even later on, in the middle of the century, I learned they used to buy diesel engines to supplement the water power. And the grist mills were very competently designed. In fact, there was an industry for making machinery for milling which was advanced compared to the rest of Europe in industry, even the German industry. It was on a much higher level of competence.

And in the 19th Century, in the last decade of it, there were two men, young men in Praha. Both of them steam engine designers. Both of them of different companies. And the School of High Technical Learning decided they would like to start a factory for steam turbine engineering. Steam turbine was just emerging, just was getting to be known in Europe, yet the school decided to go ahead with it. And it was obvious that one of these men would get an invitation. And since one of them was a Czech and one of them was a Slovak, the invitation was given to the Czech whose name is Zvonicek. And Stodola, disappointed, disillusioned, departed and went to Switzerland. And in two years time he was invited to chair the School of Steam Turbine Engineering at the Teknikholshel Holshul ? in Zurich.

What was your first experience with airships?

We were aware of the work of Zeppelin in Friedrichshafen. At least I was, as early as about 1911. And we followed it very much because it was exciting, interesting. And later on, in 1915, I was in school one day and there was a noise which was unusual because we never heard such noises before. And we all ran to the window because it apparently was in the air. And there was a Zeppelin flying north. And the Zeppelin was travelling from somewhere south. They had a base in Bulgaria

and in Romania and subsequently through 1915 we saw at least eight or nine of them traveling over us. And one of them in the fall of 1916 was going north against a very heavy head wind and barely making any progress at all, so much so that I could run underneath it. They were about 400 feet, and perhaps even less, above me. And I could keep up with them while they were flying until the darkness came and then I had to return walking exhausted from it.

But airships had made an indelible impression on me because of their ease of travel which was a travel even though it was at low speed. Although the first airship I saw appeared to be at quite a high speed trip because, whether the wind was with them, I don't know, but it was moving very fast. And the noise, of course, was unique because there were no airplanes in those days except the military. And trucks and automobiles were completely off the streets because of the war, so the aircraft engine made itself known even though it was on an airship.

And we had, later on, we had some exposure in Zeppelin also because two members of Bohemia population, Dr. Arnstein, was the head designer of the Goodyear-Zeppelin (Company). He was from Praha. But his brother was a banker. And the second one was Dr. Klemperer who came from Northern Bohemia. And he and I became close friends when in this country and I cooperated with him on a proposal for airships in 1968 which he was commissioned to do by a group of people from Oklahoma. Who they were, I don't know and neither did he know. It was done through a third person. But I was invited to prepare a chapter on propulsion of airships for his report, which I did. And he included it and submitted it and nothing apparently happened after that.

When did you come to this country?

And when I came to this country or before I came actually, this was 1932. In 1923 I came to this country and entered the Union College and I came there because Steinmetz used to teach there. To my disappointment, when I got the first paper on shipboard in New York, there was an announcement that Steinmetz died. But I could see later on when I was in Schanectady—I lived on a street only a block away from the street he lived on—and I never ceased to have admiration for the man. He had a big brick house. A red brick house and a tremendous greenhouse attached to the house and I learned that he had a family continuously of twelve to fourteen children. He adopted them and he saw to their education, brought them up, and this house was so big because actually was a house of a big family. And he had servants who were taking care of the children while he was at work. He himself took care of them as much as he could by his talking with them and by influencing them.

He had a tremendous reputation in Schanectady of very highly humanitarian purpose. So I always have been admirer of Steinmetz. And yet he was a professor at Union College. But he worked always at the General Electric in downtown Schanectady. And the school, of course, lost him but had excellent other professors and I was fortunate to have them for teachers.

And one of them, Dr. Berg, particularly, introduced the Heavyside calculus into this country and he was able to compute transmission lines for electricity by Heavyside calculus, which at that time was still an unknown science. He published a book on it also. We were the first people in this country to be taught Heavyside calculus by him. It was developed by Heavyside in England, who was marvelous scientist.

British often produce physicists of great size. Heavyside, and there were others, of course, historically as well as in modern times. And Heavyside, for some reasons, unexplained, became a recluse. He lived in a large enclosure with his house and nobody had seen him for years and years. Dr. Berg wanted to see him and meet him. So he came to visit the place, couldn't get anywhere, and had to go back again. He came the next year. The next year he was very much more circumspect about it. He noticed that the milkman delivers bottles of milk at the door in the wall to the garden. So he just stood at the door until the door opened. The door opened and a hand reached for the bottles and at that moment, Dr. Berg opened the door himself and startled Heavyside who was an old man. As he described him, he had a beard, had long hair and white. And Dr. Berg introduced himself and, not saying that he wanted anything from him, but that he wanted to make friends. Heavyside motioned him to come in. Heavyside had several conferences with him and it was a very productive summer for Dr. Berg.

When did you graduate?

I graduated in 1925 in Technical Engineering. And one outstanding man in the graduation was Professor Pupin. And Professor Pupin was the one who made modern telephoning possible because he invented the—he discovered—the reason for telephone not being possible until that time. And that was; that a transmissional line is actually a condenser and therefore, in order to carry electricity through it, it has to have an inductance in the system. He introduced inductance, so-called Pupin Coil, which to this day is on telephone poles. You can see it off and on if you watch for it and this inductance was a coil with iron core which countermanded the capacitance over the line and made the telephone possible.

And Dr. Berg at Union College was particularly dismayed by this because he invented it also, perhaps even before Pupin. But he did nothing about it. And in the classroom which he used at Union College, he had a string attached from wall to wall with sliding weights on it. He could push these weights to proper locations and when he excited a cord, the cord would vibrate. Whereas if he had them only at one location or not at all, the cord would not respond. And that was effectively demonstration of introducing inductance into the copacitance circuit making telephoning possible.

When I graduated I had enough money to go as far as Rochester, New York. There I ran out of money so I had to get a job. And I looked where to get a job at, and I discovered Northeast Electric Company. So I went to them and they gave me a job as a student engineer which I welcomed very much and

in order to break me in correctly, my first assignment was in the heat treating department where the temperature was 120 degrees. I worked on machine tools and wound armatures for the motors and generators. And I became very skilled at it so that, later on, they started a school and I was made a teacher of armature winding of the school. I had a class of about sixty women, all of them in trouble. Either their boyfriend left them or their husband left them or somebody died and I was father confessor at this time. I told these women to wind armatures and it was a tremendous job, tremendously demanding job.

Then I accumulated enough money and I went to Detroit and my brother was in Detroit already. He was at Ford Motor Company. I came to Detroit and I got a job at—sort of a temporary job—at General Motors Corporation as a tool designer on the Lasser car which didn't exist then but it was coming in and they were tooling up for it. I did some drawings on tool design for the manufacture of the car. When the job ended, I established a good record and they telephoned somewhere, I don't know where, and I was told to go to General Motors Research Laboratory in Milwaukee Avenue, next to Westgard Blvd., General Motors building, and that they would like to see me there.

So I went there and I got a job in General Motors Research Corporation. And I was working on the first straight eight Buick engine. I made the layout of it. And then I realized that at General Motors, there was very little future for somebody like me because it was all very much controlled, very much doing things that were familiar and repetitive. And I learned that in the building was a company which was planning airships so I went there and I got a job with Aircraft Development Corporation which was projecting the metalclad airship. That was in 1925, just at the end of the year.

Who hired you at Aircraft Development?

I was hired by. . . I don't even know who hired me. I think the man was Corbett, who was the Chief Draftsman. I came there and started working on what was to be the EMO-2 later on. 1925.

Did you find that you were better trained than the other engineers at General Motors?

No. In General Motors they were very capable engineers but I was quite capable myself. In turbomachines I was superior to anybody I met so far because there was no chance. In turbomachines, our industry has been a monopoly and there were some small factories which barely made it. But two monopolies, Westinghouse and General Electric, and they did not allow American schools to open chairs for turbine engineering. General Electric stated always, "We train them, you just give them the basic things." And MIT tried to open a chair to turbine engineering and never succeeded.

This is why America as a turbine country was crippled from the beginning and that was a great disadvantage as future times showed and to be overcome.

I think that in General Motors there was a sort of an attitude to look good but not necessarily to do good. For instance, they had a room—very big room—with all kinds of equipment. There was an Ajax induction furnace, a small one. And I always wanted to have that kind of a furnace and experiment with some. The Ajax furnace has been never used. It was there as delivered from the factory and I asked for it to use it, in time, to prepare some chemical compositions of metals and melt them and test them and see what influences there may be because metalurgy then was in a very primitive state. It was not anywhere as highly developed as it is now in 1970's.

The request I made horrified them that somebody would want to use the furnace. And I was told that it cannot be done because the furnaces had to look good all the time. This was at General Motors Research Laboratory. So I knew that other equipment which they had there, testing machines and all kinds of machinery they bought, was regarded in the same attitude.

And when I had the opportunity to be with Aircraft Development Corporation, I took it without any hesitation. I was given a leave of absence of six months to come back. They felt sure that I would come back. Well, I didn't come back and that ended it.

Did you ever meet Charles F. Kettering there?

I never met Kettering. I saw him only but I never met him personally. There is a story about this also which has quite a bearing on turbine development. We will get to it later on. Kettering was involved in it also but I never met him. I used to see him only. Kettering was to me a man who was entirely different from the man the public knows. He was a man who would come, sit on a table, and talk about things which had nothing to do, what related to the subject at the time. He talked about all kinds of reveries and all kinds of things but never to the point about of what was to be discussed. And I always marveled that he came to approve something and he went away without approving it yet it was approved. And that's about what I know about Kettering.

How much input did Mayo and Kettering and their staffs have on the EMC-2?

Aircraft Development Corporation was organized by two men. And this is going to be a very long discourse now because there is so much to it. And so much that has not been known. And what I am going to say is only what I definitely know. So it has a creditability, it is first-hand information.

Aircraft Development Corporation was organized by Fritsche. Now Fritsche was a man who was politically active in Indiana and in Michigan. In Indiana he was assistant to the governor. And the governor died and Fritsche then went to other parts of Indiana and what exactly he did, I don't know. But he was a money raiser for Republican Party. And he was, that way, acquainted with major holders of the office. Among them was Senator Vandenberg of Michigan.

And Fritsche told me a story once which I have no doubt to question. It was an occasion that we were going to go together to Dow Chemical Company in Bay City, Michigan. And he bought a big bag of peanuts and shelled them and gave me about every number ten. And put the chips on the floor. And I had the most beautiful conversation with him because the man opened up. I was very close to him as I was to Upson also but Fritsche was a very likable man. And he told me during this trip why he got involved in metalclad airships.

The story is so mythological that it invites doubt. But I don't think that it is untrue. I think it is correct. He was sailing on a boat from Detroit to Cleveland. These boats were operated by an organization—they were very large paddle-wheeler boats—side wheeler boats. And it was in August, full moon, and the light was almost like daylight in the Lake Erie. And everybody went to bed already and he was on top of the deck where the lifeboats are, walking around, watching the lake and watching the moon.

He discovered an older man sitting on a bench. And they spoke to each other. And he sat down with him. But the older man and he were talking and they were talking gradually, in some way, of transport by airships. Now this older man predicted that there will be sailing in the sky and carrying freight and passengers. Fritsche became so fascinated by this that, when they parted late into morning, he even forgot to ask who the man was. And he was troubled by it. He would like to know who he is. And when morning came, he waited at disembarcation door and watched for him. And the man never showed up. So he must have departed before Fritsche. And Fritsche never found out who this man was.

But the idea of metalclad ship stuck now in his mind and it became an obsession with him. It was a lifetime program with him. So he wanted to know how to do it. . . .
(phone rings—end of tape)