5. **The Violin Maker**

As one of Natlab's section directors, former war refugee Hajo Meyer recognizes the value of the optical precision technology that a few years later will serve as a seedbed for the wafer stepper.

In 1950, Hendrik Casimir at Natlab interviews a recent graduate named Hans-Joachim Meyer. Forty-one-year-old Casimir has been leading Philips' research lab for four years. Before that, he attained widespread renown as a scientist. To the sorrow of many, he turned his back on his academic career to focus on managing Philips' now famous laboratory.

Meyer and Casimir click from the start. They're soon engaged in an animated discussion. In 1949 Meyer devoured Aage Bohr's articles on the characteristics of atomic nuclei. On his advisor's recommendation, he read Casimir's articles on the quadrupole moment—the discovery that propelled Casimir to worldwide fame as a theoretical physicist. Young Meyer is thus well versed in the intellectual legacy of the man across from him. What's more, the material inspires him. His eyes twinkle as he talks about it, and that makes a favorable impression on Casimir.

Meyer's sparkling enthusiasm is all the more impressive in light of the young physicist's background. Casimir is interviewing a twenty-six-year-old man who lost both his parents in the recent war, escaped multiple deportations, and barely survived the concentration camp at Auschwitz.

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Hajo Meyer is fourteen when he hears that he may no longer attend high school in his home town of Bielefeld because he's Jewish. It's November 1938, shortly after Kristallnacht in Nazi Germany. In the panic that follows, Meyer's parents put him on the train to Amsterdam in the Netherlands, which is not yet occupied. He will never see them again.

Young Hajo arrives at Bergen aan Zee and passes through five refugee centers. He's bored to death and finds work at a smithy, but the police send him away. Refugees aren't allowed to work. His mother, who speaks good Dutch, lends a helping hand from Germany. She writes to the Dutch Committee for Jewish Refugees, and her son is subsequently admitted to the Jewish Work Village in Wieringermeer, a vocational training center for refugees. There the fourteen-year-old may attend vocational school, where he decides to learn machining.

It's heaven for the inquisitive teen. Most of the center's residents are adults, among them many intellectuals from Germany and Austria. They're learning a trade so they can emigrate elsewhere: America, Australia, somewhere far away. Meyer befriends a math student from Vienna who tutors him, evening after evening. He also studies physics.

Meyer's crazy about engineering and music, and in the letters he writes to his parents he begs for car magazines. He can't get enough of the world around him. He visits movie theaters and museums, enjoys music, and eagerly absorbs all the knowledge that surrounds him. "I've finished my math book," he writes on October 3, 1939. "Can you send me a new one? If so, make sure you buy a very good one, for self-study."

A convoy of buses disrupts the apparent peace in 1941. A year earlier the Germans invaded the Netherlands, and now they're closing down the work village. They send most of its residents to the Mauthausen concentration camp in Austria. Meyer, now sixteen, is miraculously spared this fate. He's allowed to go to Amsterdam, where he may attend the Jewish vocational school after acing its technical admission exams. By then he's a committed atheist, and he doesn't really fit into the orthodox environment that surrounds him. But the young man's eagerness to learn stands out, catching people's attention, and a loving foster family takes him in.

Through friends, Meyer gains admittance to the Jewish Montessori high school in Amsterdam. There he receives afternoon lessons from the crème de la crème among Dutch intellectuals, all of them

Jewish professors fired from their university positions. His foster parents arrange for a well-to-do Amsterdam family to pay his tuition. Amazingly enough, the Gestapo decides the private Montessori school may hold final exams. After passing them, Meyer goes into hiding in the tiny town of Blaricum. The Germans eventually catch him anyway and put him on a train to Auschwitz.

After a few weeks of backbreaking work in the Polish concentration camp, the Germans order him to the Gleiwitz I railroad labor camp. They need skilled labor, and because Meyer has experience as a machinist, he may repair train cars. It's his salvation. The eighteen-year-old works alongside German and Polish craftsmen—in a prisoner's uniform, but the factory is heated. As a Jew, Meyer's diet is restricted to the meager and tasteless Auschwitz rations, but now and then local Polish girls sneak him some extra bread.

Twice he escapes the gas chamber. The first time, the Germans overlook him during selection. The second time—in January 1945, ten months after his arrival—the advancing Soviets force the SSers to flee, but not until they've marched the camp's residents all the way to the Oder river. "If it hadn't gone the way it did, I'd be glue, or fertilizer, or shoe polish now," Meyer later writes.

At the end of the war, the United Nations Relief and Rehabilitation Administration orders everyone to return to the country where they were first taken. And so a grievously ill and pencil-thin Meyer endures an arduous journey through Odessa and Marseille back to the Netherlands. His parents will not survive the war, but they do write a goodbye letter. They've been taken to Theresienstadt, where Meyer senior succumbs to poor health; he contracted tuberculosis a year earlier. His mother takes a cyanide pill she smuggled in with her, after she hears she's been ordered to Auschwitz.

After the war, the younger Meyer's excellent final exam scores win him a scholarship[15] to study physics at the University of Amsterdam. Because there's no money to pay for further study after he graduates, his professor tells him, "You go see Casimir."

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The misery in Hajo Meyer's life isn't enough to break him. The twenty-six-year-old physicist is radiant, bristling with energy, and he talks just as enthusiastically about nuclear spin resonance as about art, music, and cars.

Casimir sees a kindred spirit in Meyer. "Well," he tells the young scientist, "it won't be easy for you at Philips as a theoretical physicist. So spend half your time as the editor of the *Philips Technical Review*." And so Meyer is introduced to a renowned institution: a scientific journal published in four languages that enjoys global fame. He travels the world with his little notebook, writes a lengthy article each month, and becomes familiar with Natlab's every nook and cranny.

Casimir wants the young researcher to gain a wide range of experience and pushes him toward experimental work, which at Natlab is considered more valuable than theory. So Meyer works in the cryogenics group, among others, and his manager tasks him with writing the very first reports on transistors. Meyer also visits AT&T's Bell Labs in Murray Hill, New Jersey, where he and section director Haaijman receive training in the use and manufacture of transistors (appendix 1).

After that, Meyer teaches other Natlab researchers the ins and outs of transistors and how to make them. To share that knowledge with Japanese colleagues, he also spends ten weeks at Matsushita, a company with which Philips has close ties.

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The bond between Casimir and Meyer grows. Natlab's director is fond of the energetic, upbeat young man and he feels a kinship with the young researcher who, like himself, studied theoretical physics. Casimir regularly asks Meyer to visit him at home in nearby Heeze. Sometimes for a glass of wine, sometimes for dinner with their wives. They talk about Casimir's time with Niels Bohr in Copenhagen, about music, and about philosophical questions.

Meyer goes on to lead the lab's gas discharge group for a few years, and then in 1964 Casimir asks him to succeed Eddy de Haan as the director of the lab's vacuum tube research section. In addi-

tion to vacuum technology and electron guns, he'll also be responsible for optics.

As a section director, Meyer is exposed to the turmoil surrounding Hendrik de Lang, one of the few optical engineers at Natlab. De Lang studied under Frits Zernike, the inventor of the phase contrast microscope. He's an exceptionally bright and creative researcher. His specialty is the conversion of optical signals to electrical ones, a step that's crucial in signal processing and signal-based measurement and control.

De Lang is not an easy man. At the lab he's known for being infinitely stubborn and difficult. By the time Meyer becomes his boss, fifty patent proposals are stacked on De Lang's desk. None of them have ever been submitted, because the recalcitrant engineer is on fighting terms with everyone in the patent department.

Eddy de Haan has been De Lang's manager for years, and the problem weighs heavily on his shoulders. It's one of the first things he brings up while he's training Meyer to take over. "That De Lang's a very bright kid. But he picks a fight with everyone. See what you can do with these, because they're important," De Haan says as he hands Meyer the patent proposals.

One lovely weekend day that summer, Meyer settles into a patio chair to look through the pile. He's deeply impressed by the work. Meyer is interested in optics, but it's his experience as a craftsman and machinist that make him realize that machines using De Lang's inventions could achieve much greater precision. The section director is determined to protect that body of ideas for Philips.

Meyer's understanding of his optical patents earns De Lang's respect. All the patents are ultimately filed. A few years later, Meyer will create a research group that combines optics, precision mechanics, and photochemistry. It will turn out to be a crucial decision, one that seeds the ground for the development of the video long-play disc—the predecessor to the compact disc—and the wafer stepper, the lithographic chipmaking machine.

As the sixties progress, Meyer and De Lang develop a friendship. On a personal level, the director and the group leader share a love

Hans-Joachim "Hajo" Gustav Meyer

for music. Both play the violin. Meyer discovers that De Lang is a talented violin maker. *I bet I can do that, too*, he thinks. His experience as a machinist serves him well there. After he retires in 1984, he immerses himself in the craft and makes some fifty instruments, so good he's even able to sell them to professional concert violinists. He also publishes scientific articles on acoustics. Accordingly, many a Natlab researcher will later refer to Meyer as "the violin maker."