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## The Air Itself Caught Fire

The first time Johann Kempler saw the dragon was June 1926 in Lauda, Baden-Württemberg. The idyllic town, known for its railroads and vineyards, was abuzz with frenzied activity. Johann was six years old, and didn't yet know he was an orphan. The adults around him were dashing about, screaming and shouting, bumping into one another. They tripped over their own feet, cursed aloud, and carried pail after pail of water from the well at the edge of the yard. The day was sunny and sultry, and the flames roared almost invisible in the bright daylight. They curled into black oily whorls in the dazzling blue sky. Someone managed to organize the welter of people into a bucket chain. A desperate, symbolic act in the face of the inevitable.

The Kempler house was a conflagration. The fire had started in a room downstairs. Before Johann's mother Senta had had time to react the flames had first licked the ceiling's wood paneling, then bitten it greedily. The draft had sucked the flames into the gaps in the ceiling and inside the walls. Senta had scooped up her son and scrambled out. After making him swear to stay put she had run back in to wake up her husband Ewald, who had been asleep upstairs. The Kemplers' neighbor Emma had seen the rising smoke and dashed into the yard, only to find Johann crying next to the well. The flames had already consumed the house, and there was no sign of Johann's mother or father.

Johann's upper lip was sticky with snot candles and the blaze made his skin pinch with heat. Johann wiped his eyes on his sleeve; the skin around them felt raw. The neighbors with their buckets were small and pathetic next to the dragon. The water from the pails didn't even reach the flames, but flopped impotently on the grass next to the house. The heat was so terrible nobody could get within ten meters of the house. The mewling of the fire truck sirens climbed from behind the roar of the fire. Ordinarily that sound would have flung Johann into motion, to run after the engines and the volunteer fire fighters. He would've gone on half the evening about how he too would join the volunteer fire service, like his dad and granddad. Now Johann stood still and didn't cry. The tears flowing down his cheeks were from the smoke.

Johann didn't see flames. He saw the golden-eyed and fire-scaled head of a dragon, almost as big as the house it tore and gnawed at from the inside.

The dragon was like the neighbor's crazy mutt at the height of its rage. Johann and his friends had made a habit of teasing the dog until it was apoplectic, snapping at the air, tearing on its chain, trying to

push its head through its collar with such force it almost strangled itself. The neighbor, a drunken old soldier called Drechsler, had just laughed.

The burning house was the dragon's collar, through which it tried to ram its head, bellowing and chomping at air. The flames were its jaws and teeth, the incandescent whirlwind of fire was its eye. The wind turned and the dragon whipped its head around, trying to devour the people running the bucket chain. They fell to the ground screaming, crawled and rolled away from the flames. The house was so small that the dragon could scarcely push its head through — but it kept trying, ramming against the house with such fury it brought down a wall, making the fire spread and the grass turn black. It just wasn't enough.

The heat scorched Johann's face, burned his skin, made his hair curl. He had forgotten all about his parents, his home, his friends. There was only the dragon. Years later he often wondered why the others hadn't seen it. Johann himself had seen only the flames at first, but suddenly they had changed, resolved like a stereogram taking shape. Maybe it had been simply a coincidence, maybe Johann had been looking at the fire from just the right angle, in just the right way. Or maybe there was something special about Johann, something that made him see the reality beyond the flames. There was no way to say for sure.

The rumbling of the fire trucks and the howling of their sirens covered the sound of the flames. The fire fighters barked commands while unwinding hoses from giant coils. When the jets of water struck the house, Johann started screaming and wailing. He ran to the fire truck, started kicking it, hitting its doors, screaming with impotent rage. The dragon hissed and recoiled, pulled its head back, buried itself into the glowing embers, vanished. The black smoke intertwined with white, slimy, filthy steam. The humming air was full of ash and soot, and black oily water ran out of the windows and doorways.

The dragon had been wounded, it had been defiled.

Johann got to finally ride a fire truck, on the front seat. Only the day before he would have been whooping with joy, but now he hated the whole shaking and rumbling thing with the unbridled rage of a six-year-old. Johann spent the trip to the hospital sitting on Emma's lap. Emma hugged him close, held his head to her chest, protecting a small boy from the world. Johann didn't need a hug. He wasn't shaking because he was crying. He was shaking because he was angry.

An hour later Johann was sitting on the doctor's examination table and looking at his reflection in

the mirror. He raised his arm and saw his reflection follow suit. He angled his head left and right, watching the reflection of his face. Suddenly he was aware of his existence. The furniture of the examination room was made of dark wood and leather. The air smelled of disinfectant, the side tables were covered with glittering glass and metal. The window let in a slice of the sunny day. In the somber room the window was like a painting, a vision of another world.

Johann had told the doctor about the dragon, but suddenly he realized it had been a mistake. The doctor was in the adjacent room talking with Emma and another neighbor, Gisela. Emma was young, calm and smart, Gisela was old, soft and insecure. Johann could not make out their words, only the tone of the conversation. He could imagine Gisela crying, twisting her handkerchief with her plump fingers, saying how the young boy's mind had been shaken, how he was seeing what wasn't there, parents dead, oh dear, oh dear. Emma spoke in calm and precise tones. Asked, explained, listened.

Johann turned his head. His reflection followed. Johann existed.

He didn't remember reaching up onto the kitchen table at home, taking a match box, lighting a candle, and toppling it against the drapes.

The headaches started when Johann was ten years old. Emma had adopted him and raised him alone in the city of Würzburg, where Johann went to school. Emma spent her days working in a patent office and her nights studying. She often brought her work home and Johann enjoyed reading the patent applications. Devices, methods, machines, science.

Johann's first migraine attack started innocuously. In the middle of a school day his scalp started tingling, and flickering colors crept in from the sides of his field of vision. The pain was a nail to the side of his head, biting on aluminum foil, the stab from a dentist's drill, ice cream on the exposed root of a tooth. Johann fell off his chair and curled up on the floor in a fetal position. Through the pain he was aware of being carried out of the classroom. People were talking, Emma was crying, the headache made it impossible to speak.

Johann came to in his own bed. There was a low murmur downstairs, and the pain had faded into soft exhaustion. Johann fell asleep and saw the city of Würzburg in flames. The fire fell from the sky in small seeds made of metal. The first seeds blew up and smashed the tiled roofs of the city into gravel that rained on the streets. The next seeds blossomed out into flares that engulfed Würzburg's houses, streets and monuments. As the flames withdrew, they were followed by soldiers equipped with peculiar helmets and rifles, and machines rumbled in behind them. Above the city, among the conflagration,

danced a dragon like a long flaming ribbon. Danced until the flames died down.

The headaches followed Johann through school, striking a few times per year. Johann quickly learned to recognize the first symptom, the flames flickering in the corners of his eyes. Sometimes in the middle of a football game or in class he had to dash to the closest dark place and curl up, hands over his eyes, before the pain struck. The attack was always followed by a deep sleep and visions of blazing cities and dragons. Sometimes Johann recognized the city, sometimes it was in a foreign land. He dreamed often of Würzburg and an oriental city sliced apart by rivers, the skies over them raining down seeds of fire. They pierced the fragile roofs and made block after block open up in flames like a vine in bloom. The sky growled, the fire bellowed, a dragon shot up from the inferno, its dorsal sail a long red flame whose edges faded into smoke.

After the first few times the dream started to change, to become more elaborate. When the dream angled up toward awakening and the thoughts of the waking world started seeping through, Johann began seeing the dragon's egg. It didn't resemble any of the avian or reptilian eggs Johann had seen in school, but he knew immediately what it was. The dragon's egg didn't have one shell, but many. The outermost shell was made of fragile metal, and under it was a layer of thick scales. Inside that layer was the warm yolk, and right in the middle, a heart made of hard metal, ready and shivering with eager anticipation.

The world held its breath, waiting for the first beat of the dragon's heart.

Johann grew into a talented but reclusive preteen. He considered children of his age to be childish, alien, not quite present in the world. Johann often returned to that moment in the doctor's examination room when he became conscious of his own existence. That was his real birth.

Then there were the adults, who were distant, weird and blind in their own ways. They kept underestimating Johann, judging him to be but another stupid child. Some of them were children themselves, hiding in the bodies of adults. The only person who didn't seem to underestimate Johann was Emma. Once, after Johann had asked her a question, she paused to regard him thoughtfully.

"Heavy thoughts for a little boy. You are a very special child, you know that? My little man."

Emma took Johann's questions seriously and replied to him like she would to an adult. Johann grew up to understand that Emma was an exceptionally smart and talented woman. She answered Johann's questions regarding astronomy, physics and chemistry. They played mathematical games, such as calculating the square roots of hymn numbers during the boring Sunday church service.

“Why aren’t you working at the university, as a professor or such?” asked Johann one day. Emma’s expression fell, and she spent such a long while looking quietly out of the window that Johann got worried. At last she turned around, smiled and put her hand gently on Johann’s cheek.

“People can be wise, but the world can still be damn stupid at times. Don’t you worry about it, little man, I can be your professor.”

Without the help and the guidance Emma provided it was likely that instead of higher learning, Johann would have had to pursue a trade. Instead, Johann signed up to the University of Würzburg in 1938 to study physics and chemistry. The student body was in the grips of political turmoil, but Johann had no interest in that, and neither did he take part in student activities. The university administration had been purged of the undesirables five years earlier, but both Johann’s parents and Emma were of pure Aryan stock.

Johann threw himself into his studies with such fervor that he caught the attention of the teaching staff. He read, wrote, calculated, and discussed from the crack of dawn to late at night, eschewing all other things in life. The staff learned first to look out for and then to tolerate this slender, intense young man who could barge into an office or butt into an ongoing conversation to demand answers to his questions with little social finesse. Johann soon found his niche between the students and the actual researchers — a niche of pure hunger for knowledge. By the end of his sophomore year Johann had authored a paper about optimizing artillery strikes using statistical methods. His next passion was a mathematical model for fashioning high explosives into lenses and thus directing their force in a controlled and accurate fashion.

After the fire Johann avoided open flames for a long time, be they small as a candle or large as a blazing fireplace. Slowly, though, he started finding flames more and more fascinating. He often lost track of time staring at an open fire, turning and angling his head, trying to find a position that would make the dragon manifest. He was never successful. One can’t see a cathedral by staring at just one brick.

In addition to his unquenchable enthusiasm Johann had another, less positive reason to take his studies seriously: Emma and Johann’s savings were enough for only one year of university. By the end of Johann’s first year his talent had attracted enough attention that he was given a stipend large enough to carry him over to graduation. Unfortunately, Johann never had the chance to take advantage of it.

On 1st of September 1939 Germany launched a surprise attack on Poland. The term was about to start,

but the hallways were quiet — the machinery of war had claimed its share of the nation's young men. Johann had been deemed unfit for service in the front lines, but the Wehrmach had other plans for him. In the spring, seven talented physicians had met in Reichserziehungsministerium to discuss the potential military applications of nuclear fission, which had been discovered the previous December. The Uranium Club, as the group was called, started its unofficial research at the Georg-August University of Göttingen, but the war effort made the endeavor important on a national level. The Uranium Club was transferred from under the Reich Ministry of Education to the auspices of the military and the Waffenamt. The recruiters, who had made their surreptitious tours of the university, had already flagged Johann as a potentially valuable wartime resource. Young, brilliant, apolitical, from a poor background and imbued with a thirst for knowledge. Give a young man like this a meaning, a mission, and resources — and wait for the results.

When Emma heard Johann was about to get involved with the military, she was furious. Unlike Johann, Emma was very political. She couldn't stand the National Socialist party, and she was not afraid to make it known. In her books, the invasion of Poland was a crime that could only lead to senseless loss of human life. These opinions didn't make Emma popular. Her house got vandalized with paint and she was suspected of harboring Communist sympathies or of having Jewish roots. The latter led to a couple of official visits and interviews, but nothing came of them. It was a small miracle that Emma's political activism didn't prevent Johann from being recruited, but the interviews made it exceedingly clear that Johann couldn't care less about politics. At the end of September, Emma stood watching from the doorway as Johann stepped into an army vehicle. It would take him to the train station, where he would continue his voyage to Berlin-Dahlem and the Kaiser-Wilhelm Institut für Physik. The chauffeur closed the back door of the car and walked around to the driver's side. Johann kept looking at Emma, whose mouth was an angry hyphen, her eyes full of sorrow. Johann would never return to Würzburg or Lauda, and he would never see his adoptive mother again.

The next few years were the happiest in Johann's entire life. He had originally been recruited as an assistant to do academic grunt work: to transcribe papers, to complete the most boring and time consuming calculations, and overall to handle all such tedious academic odd jobs with which the time of brilliant researchers would be wasted. He met such geniuses as Werner Heisenberg, Ropert Döpel and Hans Geiger, and managed to get their attention with his sudden insights and surprising inquiries.

The migraine attacks grew less severe, but dragons kept haunting Johann. He dreamed of them

often, even without the accompanying headache. Although the shape of the dreams remained constant, their details evolved.

The roaring blaze that had first lapped up cities transformed into a scorching welder's flame — a brilliant raging wave that swept the buildings down like they were made of matchsticks, bringing with it a sea of boiling orange-white death, making people explode into clouds of coarse ash, burning its way through earth and stone with unimaginable heat. It made the air catch fire in colors that could not be produced by a lit fireplace, a burning house, or a city ignited to a blaze. It was pure fire, the flame that sits at the core of the universe, burning its way through realities. The dragon's egg, and inside of it the yolk — the warm, hard heart, waiting to beat for the first time.

Johann immersed himself in intensive research. He published his paper on explosive lenses and started over a dozen papers on other subjects. He couldn't finish a single one. Each new topic caught Johann's interest for a moment, but invariably his concentration floundered. Other topics felt thin and inconsequential in a way that frustrated Johann almost to tears. He was put on this Earth to do something — but what that might be, he couldn't figure out. Still, Johann's career flourished. He ended up working as Paul Harteck's assistant in Hamburg, isolating uranium isotopes and determining how to use heavy water as a neutron moderator.

Outside the walls of the institutions in which Johann was working, the war tore first through Europe, then the world. For Johann, it was a distant abstraction. News from faraway lands, empty propaganda, a needless distraction — right up to the bombing of Hamburg, when Johann saw the dragon in the waking world for the second time.

On the 24th of July 1943, the British and U.S. Air Forces launched Operation Gomorrah, killing over 40,000 civilians and wounding almost as many. The summer had been hot, so the vegetation, the buildings, the ground itself were bone-dry and dusty. The first bombs fell three minutes before one in the morning, and they kept falling for eight days and seven nights. Anti-aircraft fire lit up the sky day and night. A thunderstorm tore the sky apart for a moment, but the rain wasn't enough to put out the myriad fires raging in the city, or to moisten the parched earth. The night after the thunderstorm, a moment before midnight, seven hundred and eighty-seven bombers rumbled across the sky and dropped hundreds of bombs in half an hour. The fires they lit created a vortex of superheated air, an immense fire tornado that sucked air, dust and debris hundreds of meters above the city. The asphalt on the streets caught fire, people asphyxiated in their bomb shelters as all the oxygen was eaten away, and

fiery tempests tore people off the streets. The air itself sizzled, ready to ignite.

Johann was watching the fire tornado through the window of his small garret, saw the formation convulse and twist like it was in great pain. In one final spasm the vortex gave birth to a dragon that tore into the sky like a burning whiplash. The dragon coiled and whirled around the burning funnel, bellowing with joy, snapped at the anti-aircraft shells and bombers passing by. It rolled and frolicked on burning houses, rubbed itself on buildings that turned into bonfires, launching billowing clouds of sparks. Block after block, the city caught fire. The dragon swished its tail at the harbor, igniting the oil leaking from the ships into the river Elbe and the canals crisscrossing the city. That night not even water was safe from fire.

Johann watched the dragon, rooted in place, squeezing the windowsill. A bomb struck nearby, made the building tremble. A windowpane split in half with a loud snap. The dragon, still frolicking in the murderous firestorm, kept one eye on Johann. Johann stared back, until a migraine attack made him collapse on the floor. He dreamed of a dragon's egg that was yet to hatch.

In the morning, the fires were still roaring, but the dragon was gone.

In the August of 1943 Johann sat in the cramped stateroom of a fishing boat, pummeled by the waves of the North Sea. He clung onto a canvas bag brimming with papers, folders and documents — a random selection of research materials he had scrounged together before the time had come to meet the Norwegian resistance on the outskirts of Oslo. A week later the boat would arrive in Aberdeen, from where Johann would fly to the United States.

The German atomic program was faltering, a fact Johann had realized over a year ago. It had been deemed useless to the war effort, and the military had handed the research back to civilians. Most of the scientists had moved on to other projects, and those still interested in nuclear fission were researching it mainly as a power source, which wasn't Johann's strongest area. Excluding Jewish scientists from academia had led to the loss of sorely needed expertise, and the research was folding into ineffective disarray.

The heavy water plant of Norsk Hydro in Norway was central to the German atomic program, and had been a target for sabotage on many occasions. In the February of 1943 a Norwegian commando unit had blown up the plant's electrolysis chambers, rendering it inoperative. Johann had been sent to evaluate the situation from a scientific viewpoint and to save all the research he could. Only when he arrived in Norway did Johann finally have to face the destruction the war had wrought

upon the world. He was outside of his academic bubble, meeting the angry gazes of the civilians, realizing that Germany had reached the end of its road. Waiting for him at home was death in an Allied bombing in the worst case. Even the best case included giving up scientific research, facing long interrogations, perhaps incarceration. There would be no resources to continue his research, and life would turn into a fight against starvation. None of these options were acceptable.

It took only a week to get in contact with the Norwegian resistance. Faced with a potential defector from the German atomic program, the Allies didn't dally.

Johann's trip to the United States consisted of a series of small cells. The locked stateroom of the fishing boat, a bedroom in Aberdeen, an isolated compartment in a bomber, a series of locked rooms in the U.S. and finally a hot, dry cell where Johann ended up spending weeks. He was surrounded by big, serious men carrying guns, some of whom looked at him with curiosity, some with barely concealed hatred. Johann's documents had been confiscated in Aberdeen and he had been interrogated almost daily about the atomic program, German military strategies and resources, and Third Reich leaders and people of influence, whom Johann knew mainly as faces among many at official events he had been forced to attend. If it wasn't science, Johann couldn't give many answers to his interrogators, but he was happy to talk about his research, since the fruits of science belonged to everybody. When it became clear that Johann didn't know much about practical military issues he was left alone for a while. The interrogators clearly didn't understand the research Johann would've been happy to divulge. He kept hoping that the papers he brought from Norway would reach someone who understood their value.

Johann spent two weeks in the cell before receiving visitors who weren't military intelligence or air force. The building where he was kept was probably in a desert somewhere. The air was arid and smelled of dust and unfamiliar plants. The soldiers tracked in sand the color of brick dust, which Johann gathered into small piles in one corner of the room. When the cell door opened this time, two soldiers carried in a metal table, which they set down in front of Johann's only chair. On the table they set down a reel-to-reel tape recorder and a few reels. The soldiers were followed by the actual guests, who brought in their own chairs. Two men in their forties, one of them balding and endowed with a round, friendly face, the other slim and with an unruly tussock of hair. They were followed by a soldier who stood in the doorway, hands behind his back, feet wide apart. The man with the round face greeted Johann in German tinted with a slight accent – maybe Hungarian. He set a document in front of Johann, who recognized it immediately. It was his only published paper, the one describing

mathematical models for explosive lenses.

Johann smiled. These men were scientists, his tribe.

The conversation took off as if the men had known for years, and lasted late into the night. The round-faced man was John von Neumann, the other Seth Neddermeyer. Johann knew von Neumann by name and reputation: he was one of the greatest mathematicians and polymaths of the era. During the first visit they discussed Johann and the state of the German atomic program, with Johann doing most of the talking and the others supplying occasional questions. When the men returned the next day, it was their turn to speak.

In an atom bomb, nuclear fission was achieved by smashing together a critical mass of plutonium. The neutrons released by this collision hit other plutonium atoms, which release more neutrons, which hit more atoms and so on — the fission progresses and the weapon detonates. One way to achieve fission was to construct the bomb in the form of a tube, and shoot a small plutonium bullet through it into a larger mass of plutonium. The problem was that plutonium-239 spontaneously turns into plutonium-240, which achieves fission more easily. When the bomb was triggered, a small amount of plutonium-240 would detonate quickly, blowing the device to pieces and scattering the rest of the plutonium to the four winds. It would be a nuclear detonation, but much smaller than intended.

Johann listened to the explanation and commented where he could. They had reached similar conclusions in Germany, but the Americans had obviously progressed much further. But all this was merely an introduction; something else was coming.

Von Neumann licked his lips and glanced at his companion. There was another method: implosion. The plutonium would be cast into a sphere, which would be encased in directed explosives. Johann's heart started to thump louder, and flames licked the periphery of his vision. The tape recorder hummed on the table, its reels stirring the warm air lazily. Von Neumann pulled a sheet of paper in front of him and drew on it a series of concentric circles. A nuclear device like this would have multiple layers, one of those comprised of explosive lenses. The pressure wave produced by them would have to be perfectly symmetrical and impeccably timed. Johann stared at the diagram, his brow turning slick with sweat, the first stabs of the migraine pulsing on his temples. His thoughts started drifting apart, somewhere far away the dragon bellowed.

"...egg..." was all he could mumble before the pain split his skull like a pickax.

Hours later, Johann woke up alone in an empty cell, still groggy and half of his scalp totally numb. He

stumbled to the door and hammered it with his fists until a guard arrived. Johann asked for a pencil and some paper. The next day, he handed von Neumann a stack of documents outlining the structure and functions of an implosion device. The bomb had an outer metal casing covering a layer of polygonal explosive lenses. Inside were layers of more explosives, uranium, plastic, finally plutonium, and right in the middle, a beryllium-polonium sphere to act as a neutron source.

As Johann explained his design, von Neumann stared at the diagrams quiet and blinking, and Neddermeyer had a peculiar air of dissatisfaction about him. When he was done, the men started talking in English to each other, a quick babble of which Johann understood only a word or two here and there. Finally von Neumann addressed Johann and started asking detailed questions about the structure of the device and the calculations behind it. The discussion stretched on late into the night, as sheet after sheet filled with equations and diagrams. At one point von Neumann tapped a diagram of the explosive lens layer with his finger and chuckled that it made the bomb look like a giant football.

Johann didn't agree. To him it looked like a scaly egg.

July 15th 1945, the night before the Trinity test. Early the next morning the first atom bomb, named the Gadget, would bring the core of the sun to kiss the ground at the Alamogordo Bombing and Gunnery Range. The most critical part of the Gadget, the plutonium core, had been assembled in the bedroom of the nearby McDonald Ranch House, the desert wind tugging at the plastic sheets covering the windows and fastened with duct tape. Later the core had been encased in an explosive shell in a tent in the desert. The Gadget was a hand-made combination of impeccable precision and improvisation. Its innermost part, the neutron initiator, was fastened with Scotch tape.

Johann sat together with Donald Hornig next to the bomb in a small shack on top of a 100-foot steel tower, rocked by the storm outside. The Gadget was armed and ready to go. Rain hammered the corrugated iron roof, and the shack was lit only by a single, bare light bulb. Hornig was quiet, engrossed in a book he had brought. Johann watched the bomb. It was, by and large, the device he had drafted in his small cell in the New Mexico desert two years earlier.

The Third Reich was beaten, Japan still fought desperately, and the Soviet Union made a whole lot of politicians very nervous. Firebombs had scorched Würzburg, Dresden, Nagoya, Tokyo, Osaka and numerous other cities, and the Allies had marched into Würzburg. Johann didn't know what had happened to Emma. The letters had stopped coming three years ago when Johann was still living in Germany. He hadn't remembered to read, or even open, the last few of them.

The weather forecast had given everyone a nasty surprise in the form of thunderstorms for the late night and early morning, and the scientists had wanted to postpone the test. But politics trumped practicality. The Potsdam Conference was about to begin, President Truman was getting ready to meet Stalin and Churchill, and he was about to demand unconditional surrender from Japan. Before that took place, it was necessary to know if the United States possessed a nuclear weapon as part of its arsenal. Storm or no, the Gadget would be detonated early in the morning on top of a tower made of metal, in the middle of a flat desert.

Lightning flashed and the thunder rumbled outside the shack. Hornig looked up and threw a nervous glance at the X-units he had developed, the detonators of the nuclear device. He started muttering as if he was praying. It took a moment before Johann realized he was counting the seconds between the lightning and the thunder. A week before the Trinity test a lightning strike had made an X-unit trigger spontaneously, but luckily it hadn't been attached to explosives at the time. The X-units were there to make sure that all 32 explosive scales of the bomb would be triggered at exactly the same time. If one of them went off one millionth of a second too early, the device would just be blown to bits and destroyed. If they functioned as intended, the plutonium would be symmetrically compressed, causing a uniform wave of neutrons to flood through it. A critical mass, a symmetrical fission, a detonation.

Hornig had been ordered to climb up the tower to keep an eye on the Gadget in case of sabotage or lightning – although if an X-unit fired prematurely, it was unclear what he could do about it. Johann had volunteered to go with him; he didn't want to let the bomb out of his sight.

At midnight the phone in the shack rang, and Hornig and Johann were recalled to the bunker. The test would commence at 5:30 am.

Johann was the last to see the atom bomb before it was detonated. As Hornig tramped down the metal ladder, Johann stopped next to the Gadget and put his hand on its warm metal chassis. The heart of the bomb was ready to beat.

The morning was cool and brisk, and the sky was clear. The scent of the night's rain hung in the air. The scientists were awake, nervous, scared, enthusiastic. Their voices a little bit too tense, their eyes a little bit too bright. The first nuclear test in history had three possible outcomes. A dud would be a huge setback for the whole nuclear program, and a successful detonation would spark a new era lit by the glow of a splitting atom. The third option was the end of the world. The scientists involved in the

Manhattan Project had been debating and even placing bets if a nuclear fission event like this would ignite the atmosphere, and if so, whether it would destroy just the state of New Mexico, or the whole world. Enrico Fermi estimated the chance to be one in ten, Weisskopf was worried about the theoretical chance of an atmospheric ignition, but Teller didn't think the detonation would have nearly enough energy to do that. On an intellectual level, nobody believed in the end of the world, but as the test drew near, some of the visages cracked to reveal hidden doubts.

The radio in the bunker crackled and the countdown to the detonation began. Johann's scalp started tingling and going numb. He kept muttering "Not now, not now!" under his breath, tried to push away the encroaching migraine with sheer willpower. Johann's heartbeat was slow and puissant, and wave after wave of pressure flooded through his head, each deeper and slower than the last. Johann leaned on a metal desk, the voices around him grew distant, the waves of numbness turned into stabs of pain. Johann fumbled with his wrist, found his fluttering pulse. The heartbeat pounding in Johann's head wasn't his. This wasn't a migraine; this was something else.

The heartbeat stopped abruptly, the noise in the bunker crashed over Johann. The next pulse of the headache didn't arrive, and the pain held its breath.

The radio crackled again, the countdown cut off, and a public radio channel hopped on the same frequency. Classical music — Tchaikovsky?

The earth under the bunker buckled, a chest-squeezing wave of force slammed through everything. Dust and plaster rained down from the ceiling, the lights flickered. The wall the migraine had been beating against all these years collapsed as the heart thumped stronger than ever before. The pain flared so bright that it lost all meaning, it turned into light, clarity, a window into a world of pure flame. Someone shouted, someone whooped. Kistiakowsky slammed open the bunker door and dashed outside to see the fireball. Johann stumbled after him, clipped the door frame, almost fell.

The sun had risen over the desert, the hills glowed bright all around Johann. The light was supernal, iridescent, scorching, just like in Johann's later dreams. It had been the first beat of the dragon's heart, which would beat a second time, a third, a fourth. The pressure wave rushed toward Johann and Kistiakowsky. A wall of dust slammed them down. The sky shone golden, purple, green, blue. The blast wasn't followed by the sudden crack of a detonation, but a long rumble, a growl, a guttural laugh that didn't taper off but grew louder and stronger.

Kistiakowsky stood up, mouth open and eyes wide, like a small child. He was looking at death, eye to eye.

A dragon soared over the desert, its body made of atomic fire that dazzled in unseen wavelengths – beautiful and terrible, a destroyer of worlds. It coiled and swooped around the mushroom cloud, whipped it with its tail, illuminated the entire desert with its refulgence. The air around it glowed blue. Johann tasted metal, his eyes closed of their own volition in the face of the dragon's brilliance. It didn't help. His eyelids, thin flaps of skin, couldn't stop the scorching radiance of the dragon, which perforated and burned his flesh with gamma rays and ultraviolet. Johann knew he was already dead from the radiation. The pain and the flashes kept on hammering him, every strike another collapsing plutonium sphere, a beat of a dragon's heart. Johann forced his eyes open for the last time.

The dragon wove its way up and around the mushroom cloud, hundreds of meters long, like a splash of molten metal. The air around it became brighter and brighter. Johann saw another tail lash the sky, and a third, a fourth, a fifth! Dragons spilled up into the sky from the site of the detonation, bellowing in exultation. Under their chins they carried scaly eggs, blindingly radiant, magnitudes larger than the small atom bomb. When they were flung high up in the sky, flash after flash illuminated the desert, turned the sand into glass, hammered both the ground below and the sky above. Dragon after dragon flooded the sky – tens, hundreds! They spread across the sky and set out to hunt.

Johann didn't see them anymore. The radiance of the dragons had shredded his retinas, the gamma rays were taking apart his central nervous system, his mind was burning with actinic effulgence, every heartbeat a new hatching beast.

The air itself caught fire.