During the same July 1926 festival in Donaueschingen where the sounds of “mechanical music” were unleashed upon the world, an inventor named Jörg Mager demonstrated a remarkable new instrument. He played a curious device consisting of an L-shaped handle that he turned on its axis around a semicircular metal panel; as the handle moved, a connected loudspeaker emitted a keening, disembodied tone that glided and swooped, sounding either out of tune or otherworldly. This device—the Spherophone—was intended to usher in a new kind of music based on microtonal pitch increments discernable to the ear but unattainable by most instruments. Though it was overshadowed by the more sensational concerts for mechanical piano and the Schlemmer-Hindemith Triadic Ballet, Mager’s demonstration of the Spherophone sent tremors through the audience. The journalist Herbert Weiskopf perceived in the instrument a phenomenon of profound significance for the history of music: “We do not wish to abandon ourselves to utopias,” he wrote, “but in this case the oft-misused term ‘epoch-making’ seems to be appropriate.” In his view, the Spherophone promised nothing less than the “alteration of the entire process of musical listening.”

Paul Hindemith
noted that the Spherophone was still in an early stage of development but declared it “the most revolutionary invention in the field of musical instruments” and expressed his eagerness to compose for it. At the time of his 1926 demonstration in Donaueschingen, Mager’s instrument was virtually the only one of its kind in Germany. But by the late 1920s, German inventors were constructing a bewildering array of electric artifacts, experimenting boldly with both playing interfaces and techniques of tone production. These instruments did without the familiar “moving parts” possessed by all instruments hitherto: instead of a plucked string or a vibrating column of air, the motive force was the invisible and nearly inconceivable oscillation of electrons in vacuum tubes. The result was a class of instrument so novel that it would eventually require a new organological category to account for it—the *electrophone*. Around these auspicious devices, there gathered a network of composers, performers, engineers, and journalistic acolytes brought together by glimmering visions of new musical horizons. This movement came to be known as “electric music,” and Mager was its most prominent figure.

Although electric music was nourished by the same technological enthusiasm that fed mechanical music, the two movements were in other ways worlds apart. First, electrophones were *instruments* in the colloquial sense—played live by musicians, rather than programmed and later mechanically activated—and so were more readily embraced by a skeptical musical public. While mechanical instruments threatened to make performers obsolete, electric instruments promised musicians new expressive powers, expanding their artistry by acting as “organic” extensions of their bodies.

Second, if mechanical music was a manifestation of the cool, detached sensibility of the New Sobriety, electric music resonated with the apocalyptic spirit of expressionism, the diffuse artistic mood that flourished in the years around the First World War. Expressionist artists believed that progress in art required the destruction of hidebound rules and aesthetic dogma, favored the sublime over the merely beautiful, and rejected the down-to-earth materialism of the modern age in favor of the search for profound depths and extreme experiences. Mager’s vision of electric music was a technological manifestation of this temperament: he attempted to burst the bonds of the conventional instrumentarium in order to create a new world of sounds commensurate with the unbounded longings of modern humanity.
Finally, the electric music movement embodied a spiritual attitude toward technology. Mager’s instruments were manifestations of the “electromagnetic imaginary,” where high technology rubbed shoulders with metaphysical speculation. While H.H. Stuckenschmidt championed mechanical music as an art form suited to the modern, scientific worldview with its distrust of unseen forces, Mager and his allies heard electrically generated tones as manifestations of primal energy, signals from the beyond. In his profile of the inventor for the modernist music journal *Melos*, the journalist Hans Kuznitzky wrote that Mager’s instruments embodied the “romantic experience and affirmation of the machine age, the age of technology.” Kuznitzky linked Mager’s instruments to the “radical abstraction” of Oskar Schlemmer, seeing in the work of both men the glimmering of a “new romanticism […] a mystical immersion in a newly conditioned attitude toward life.” Mager’s inventions were unified by an overarching utopian vision: he pursued the ideal of a musical instrument that would put at musicians’ fingertips the unlimited possibilities of what Ferruccio Busoni called “abstract sound.”

**MICROTONAL PRELUDE**

Jörg Mager was born in 1880 in the town of Aschaffenburg, near Frankfurt in northwest Bavaria, to a mother who was a church singer and a father from a long line of clockmakers. He grew up in modest circumstances as one of thirteen children. Though the family’s poverty prevented Mager from attending conservatory, he studied music on his own, originally with the aspiration of becoming a composer. Having settled on the vocations of schoolteacher and church organist, Mager became serendipitously involved in instrument building in the summer of 1911, when—according to his own telling—a heat wave wrecked his church pipe organ badly out of tune. Intrigued by the instrument’s strange new harmonies, Mager conducted an experiment in tuning. He procured a set of organ pipes and carefully tuned each by ear to create a quarter-tone scale, interleaving an additional pitch between each of the twelve semitones of the conventional keyboard. With this, he had in his own words “founded quarter-tone research in Germany.” Mager eagerly immersed himself in the history and theory of tuning. In the clutch of enthusiasm, he penned a letter to Richard Strauss informing the famed composer of his potentially epochal discovery. Strauss expressed a guarded interest in Mager’s undertaking but drily noted that he would continue to make do with the half-tone scale.
Soon after his first experiments, Mager commissioned the construction of a quarter-tone harmonium (a portable reed organ) built to his specifications. The instrument had two manuals, each tuned in twelve-tone equal temperament, but the upper manual was tuned a quarter-tone higher than the lower manual. Quarter-tone intervals were thus obtained by playing the two manuals simultaneously. In Mager’s first published writing, the 1915 pamphlet *Quarter-Tone Music*, he set out a subjective but systematic catalog of the various new sonorities of the quarter-tone system. He listed each of the eleven new dyads and provided short characterizations of their sounds. The interval between C and raised D (five quarter-tone steps), for example, is “unruly, pressing for resolution, [of a] robust character,” while the interval of seventeen quarter tones (equivalent to a raised augmented fifth) “sounds good; each tone is independent, not fusing together, but standing out.” He also catalogued all the new triads of the quarter-tone system, grouping them as variants of the four diatonic types (major, minor, diminished, and augmented). For Mager, this experimental probing served to demonstrate the musical viability of the quarter-tone system: “The research of possible quarter-tone applications is concerned at first with simple progressions and passages. [...] One is surprised by how clearly this smallest interval can be perceived by every normal ear!” Mager’s harmonium thus represented a peculiar application of instrumental technology: it was something between a conventional musical instrument, which it outwardly resembled, and an instrument in the scientific sense—a device for imparting knowledge about the empirical world.

Mager’s microtonal fascination was part of a broader tendency in early twentieth-century music, the aesthetic and technological implications of tuning were the objects of heated debate among scientists, musicians, and intellectuals of the time. As early as 1863, Hermann von Helmholtz had argued in his widely read *On the Sensations of Tone* that tuning systems are based less on the unchanging nature of sound than on the vagaries of human culture. Helmholtz’s investigations into alternate tunings helped sanction a number of microtonal experiments in the late nineteenth century, such as the “bichromatic piano” G.A. Behrens-Senegalden patented in 1892. In 1911, the same year as Mager’s first experiments with his detuned organ, Arnold Schoenberg mused on the prospect of expanding the scale beyond the limits of twelve-tone equal temperament in his *Harmonielehre (Theory of Harmony)*. His attitude toward the matter was highly ambivalent: on the one hand, he acknowledged that the division of the scale in increments
smaller than the tempered semitone was likely an historical inevitability; on the other hand, he seemed to dismiss current efforts to make use of these finer intervals and deferred the realization of this goal to a distant future, arguing that experiments in this domain “seem senseless, as long as there are too few instruments available to play them.” The necessary instruments would appear, he said, as soon as the “ear and imagination” were prepared: “For it is far more a matter of mind and spirit than of material, and the spirit must be ready.” In spite of Schoenberg’s skepticism, his discussion of tuning in the *Harmonielehre* became a frequently cited touchstone for microtonal composers and instrument builders.

Around the same time, the German sociologist Max Weber was investigating tuning in his study of the social and historical development of European music from the standpoint of mathematical rationalization. For Weber, the logical endpoint of musical rationalization was the establishment of twelve-tone equal temperament, which replaced the heterogeneous welter of earlier tunings with a unified system based on a single interval. The dominance of equal temperament exhibits the double edge of rationalization. On the one hand, it enabled the uninhibited modulation between keys and the chromatic enrichment of harmony without which postclassical music would be unimaginable: “Only temperament brought [music] to full freedom,” Weber declared. But on the other hand, he argued that the leveling of differences between keys and the dominance of the uniform tempered semitone had dulled listening habits and shackled music in “dragging chains.” The rationalization thesis suggested that music had been led into a technological cul-de-sac, a closed system whose finite possibilities were rapidly approaching exhaustion. Significantly, Weber’s study of tuning predated by several years his renowned thesis of the “dienchantment of the world,” which would become a keynote of twentieth-century social theory.

The themes of tuning, disenchantment, and musical rationalization also found expression in contemporary literature. *Syrinx*, a novel published in 1914 by the writer and poet Julius Maria Becker (1887–1949), tells the story of a schoolteacher and church organist named Hamann and his quest to overcome the suffocating constriction of musical expression imposed by conventional systems of tuning:

We should cry out at the brutality of our scales. They defraud us of the subtlest gradations available to the domain of sound and pin down an infinity to twelve points. They are twelve columns in a river without bridges connecting them; the whole thing is in truth an acoustic fragment with whose
imperfection the world cannot be content. [. . .] Do you know what we have done to the flowing sea of sound? We have run it through a sieve and come up with these twelve drops, which give only a faint idea of the vastness of the primal sea.¹⁹

In order to tap into the oceanic infinitude of the pitch spectrum, Hamann builds a new kind of organ in which the player, by increasing pressure on the key of his instrument, triggers an electrical mechanism that shortens the length of the corresponding pipe in proportion to the pressure applied, thus creating a continuous, glissando-like transition from one tone to the next. With this instrument, he achieves “not merely a technical refinement of the organ, nor a reform of music all told, but rather a symbolic solution of the secret of the world.”²⁰ Syrinx is a remarkable testament to the convergence of technology, music, and metaphysics in the early twentieth century. In spite its seemingly far-fetched premise, the novel had a firm basis in reality: Becker’s protagonist was modeled on none other than Jörg Mager.²¹

The notion that the musical language of the classical-romantic tradition was incapable of further development became an article of faith among modernist musicians of various stripes in the early twentieth century, one that provoked a wide array of solutions and reactions to the perceived dead end of common-practice tonality. Mager, for example, lamented the depletion of the “gold mines of musical expression,” noting that composers such as Wagner, Liszt, and Strauss had already stretched the limits of the chromatic scale.²² What made Mager’s interpretation of the exhaustion thesis unique was its technological spin. Like Busoni, he was convinced that new instruments alone could surmount the impasse music had reached in the early twentieth century. In this, his position was more radical even than that of a composer such as Schoenberg: for Mager, the free circulation of all members of the chromatic scale only highlighted that system’s limitations—rattling the cage of twelve-tone equal temperament instead of throwing open the gate. The exploration of new systems of tuning based on intervals finer than the tempered semitone, then, was more than a merely technical matter. In Mager’s view, this quest was nothing less than an attempt to ensure the future of music as a living form of art. If the history of tuning had traced a trajectory of disenchantment, Mager suggested that enlightened technologies could reinstate the unspoiled wholeness that had been sacrificed on the altar of musical rationalization. His goal, in short, would be to capture the infinite in an instrument.
ELECTRIC MUSIC

Mager’s pamphlet on quarter-tone music was published in 1915, in the thick of the First World War. The inventor was soon called to the front, where he served as a soldier and medic. As a committed socialist, Mager later took part in the Communist uprising in Munich, but after its failure he was forced to flee for Berlin, fearing prosecution for his involvement in the attempted revolution. (According to one unconfirmed legend, he served for three days as minister of culture for the short-lived Bavarian Soviet Republic.)

In the German capital, Mager found himself in one of the major centers of microtonal research in Europe. Ferruccio Busoni, whose influential Sketch of a New Aesthetic of Music had proposed the possibility of the division of the whole tone into thirds and sixths, was summoned to the city in 1920 to lead a master class at the Academy of Fine Arts, and his presence drew a number of young composers who were interested in microtonal composition and instrument building. By 1922, the Berlin circle of microtonalists included the Czech Alois Hába, the Russian Ivan Wyschnegradsky, and the Germans Mager, Willi Möllendorf, and Richard Stein. They all were veterans of the microtonal scene: Stein had composed and published quarter-tone music as early as 1909; Mager and Möllendorf had built quarter-tone instruments in 1912 and 1914, respectively; and Wyschnegradsky and Hába had had their microtonal works published and performed. However, none were satisfied with the available means of realizing their music.

In the fall of 1922, the five men convened to determine a course of action for the development of microtonal instruments. Although the conference ended without any clear resolution, it was a decisive event for Mager, who by this time had come to see the quarter-tone system as an unacceptable compromise between his ideals and the limitations of conventional instrumental technology. The meeting cemented his decision to abandon acoustic instruments in fixed tuning and instead attempt to gain control of the pitch spectrum by means of electric tone generation.

Mager’s electric leap was made possible by the precipitous development of radio equipment in the first decades of the twentieth century, a period of rapid technological change that one historian has dubbed “the dawn of the electronic age.” In techno-historical terms, “electric music” was an accidental by-product of the development of radio broadcasting: modern electronics grew out of a little glass bulb originally
intended simply to aid in the reception of radio waves. Shortly after inventing the incandescent light bulb in 1878, Thomas Edison had noticed that the cathode inside the bulb generated a mysterious emission that blackened the interior of the glass. This finding, investigated but not fundamentally understood by Edison, was later taken up by John Ambrose Fleming, who discovered that the so-called Edison effect was a process of thermionic emission, in which an electric charge flowed from the heated cathode to the anode. In 1904, Fleming invented the diode or two-element thermionic valve, which found use as a rectifier, converting alternating current into direct current and thus aiding in the conversion of radio signals into audio.\footnote{In 1906, the American inventor Lee de Forest added a third element to the diode by placing a tiny wire grid between the cathode and the anode. A relatively small signal passed to the grid would therefore regulate a much larger current between the cathode and anode, thus amplifying the original signal. De Forest’s three-element (triode) vacuum tube, which he called the Audion, was later discovered to have the remarkable capacity not only to detect and amplify radio waves but also to create its own electrical oscillations. In January 1913, the American inventor Edwin Howard Armstrong discovered that by directing the output of the Audion tube back into the input, the device’s amplification effect could be vastly multiplied, allowing it to detect and render audible even distant radio signals. Most important, for the later development of electric instruments, he found that beyond a certain level of amplification, the Audion began to hiss, whistle, and howl. It was no longer simply receiving and amplifying signals; it was now generating its own. Armstrong’s discovery of feedback (also known as regenerative amplification) would have profound implications for the fledgling radio industry, which at the time was capable of only weak broadcasts of extremely limited range. It would set in motion a major technological shift, as the vacuum tube in myriad forms (together with AC distribution systems) replaced the large and unwieldy dynamos as the primary means of generating and controlling electricity. Though audio feedback was generally considered undesirable and uncontrollable, once tamed by the proper circuitry, it would form the technological basis of electric tone generation. Electric instruments, in essence, found a creative purpose for the refuse product of radio broadcasting: “In all of these instruments,” a contemporary journalist observed, “it is ultimately a matter of deliberately creating the so-called feedback noise well-known to every radio listener—that bothersome whistling
and singing of the loudspeaker—and giving it a certain tonal beauty to rival the sounds of our traditional musical instruments.”

Following on Armstrong’s work, de Forest discovered that the pitch of the electrically generated tone was governed by the capacitance of the circuit, and thus could be controlled for musical purposes. In an article published in the radio enthusiasts’ journal *The Electrical Experimenter*, de Forest declared, “I am able to obtain a succession of musical notes, clear and sweet, of surprising volume, the pitch and timbre of which can be varied almost at will to imitate any musical tone of an orchestra.” (Tellingly, he closed the article by assuring his readers that the sounds of his so-called Audion Piano were produced electrically and not mechanically; he was aware that for the general public “mechanical” was all but synonymous with “unmusical.”) In 1915, de Forest was granted the first patent for the use of vacuum tubes as tone generators, but he soon abandoned this branch of electrical research, leaving it for others to explore.

It was in this technological context that Jörg Mager undertook his first experiments in electric tone generation in Berlin in the early 1920s. He described the path to his invention in his pamphlet *A New Epoch of Music through Radio*, published on the occasion of the first German Radio Exhibition in 1924. Here Mager put forward a radical vision of radio as a medium for new forms of music, rather than the dissemination of existing works: “The radio firms have indeed energetically championed the transmission of music through radio,” Mager wrote, “but at the same time they have shown virtually no interest in the far more significant problem of creating music.” He elaborated this claim in a “Radio Prophecy” published the same year in the journal *Der deutsche Rundfunk*:

> The music of the future will be attained by radio instruments! Of course, not with radio transmission, but rather direct generation of musical tones by means of cathode instruments! Indeed, cathode music will be far superior to previous music, in that it can generate a much finer, more highly developed, richly colored music than all our known musical instruments!

Mager dismissed inventors such as Edison and Marconi as mere technicians who were ignorant of the artistic need for instrumental innovation, while he portrayed himself as an artist-engineer who possessed both the aesthetic sensitivity and the technical know-how required to initiate a new age of music. He denounced the limited use of electroacoustics as a means of musical reproduction through
recording and broadcasting and called for creative applications of the new technologies—“a higher acoustics, a higher radio.” Just as the composers of mechanical music refunctioned automatic instruments as tools for artistic experimentation, Mager envisioned “radio-music without transmission,” a Promethean gambit to release radio-electricity from its bondage to technical reproduction and deliver it into the hands of contemporary composers.  

Sometime around 1921, using surplus radio components gathered from his job as a factory worker for the electronics manufacturer Lorenz, Mager cobbled together his first prototype electric instrument. It was a simple device in which the pitch was controlled by the rotary motion of a hand crank over a semicircular metal plate. The movement of the crank controlled the capacitance of the circuit, which in turn raised or lowered the frequency of the instrument’s tone. A button on the handle closed the circuit, generating a tone for as long as it was held down. As the player turned the crank, the instrument generated a continuous, gliding transition between tones; it was thus perfectly suited to obtain the finest microtonal inflections. Recounting his joy
upon attaining what he called the “ideal glissando,” Mager wrote, “Absol-olute music! The pan-tonal circle lay before me! The ocean of tone in its immeasurability! The omnitonium, the musical ideal of all times!”

The question of discrete versus continuous pitch space was a bone of contention among the Berlin microtonalists: although Hába welcomed Mager’s instrument, Richard Stein dismissed as “utopian” the notion that music could do without fixed scale degrees. Mager, in his defense, quoted the revered Helmholtz, who had argued in *On the Sensations of Tone* that the stepwise segmentation of pitch imposed by musical instruments such as the piano alienated music from nature, where “gliding transitions” are the rule. The appeal of continuous tonal motion was widespread in the early twentieth century and found expression in the writings and music of Nikolai Kulbin, Percy Grainger, Henry Cowell, and Edgard Varèse. For these figures, as for Mager, the glissando was nothing less than the infinite tonal spectrum made audible.

In its circuitry, Mager’s device was closely related to the instrument developed concurrently in Russia by Léon Theremin. Both employed
beat-frequency oscillators, a means of tone generation based on the heterodyne principle discovered by the Canadian inventor Reginald Fessenden in 1901, which allowed for the production of a musical tone as the by-product of two inaudible high-frequency vibrations. (As is well known from the study of acoustics, two simultaneous oscillations generate a new vibration whose frequency is equal to the difference between the frequencies of the original two.) Although developed in the context of radio transmission, the heterodyne principle proved useful in many of the earliest electric instruments: by keeping one of the high frequencies constant and allowing the other to be altered through the player’s actions, the resulting tone could be controlled with some degree of precision.43

The playing interface of Mager’s instrument was the product of a technological misunderstanding. Mager, like many others, had been awakened to the possibility of electric tone generation by Busoni’s account of the Telharmonium, the massive, dynamo-powered electric instrument built in the first years of the twentieth century by the American inventor Thaddeus Cahill.44 In his Sketch of a New Aesthetic of Music, Busoni described the instrument as “a comprehensive apparatus which makes it possible to transform an electric current into a fixed and mathematically exact number of vibrations” and attributed to it the ability to attain “the infinite gradation of the octave [. . .] by merely moving a lever corresponding to the pointer of a quadrant.” But the playing interface described here was completely fabricated: in reality, the Telharmonium was played from a conventional musical keyboard. Busoni, who never saw the instrument in person and based his account on a single article in an American magazine, grafted Cahill’s actual invention onto the fantastic product of his own imagination, a “universal instrument” capable of generating any frequency with the turn of a dial.45 Mager’s description of the Telharmonium essentially parroted Busoni’s:

> With a lever the tone apparatus is set to the desired number of vibrations. The extraordinary richness of tones enables an extraordinary fullness of harmonies. This great number of tones can be most easily named with the number of their vibrations [i.e., their frequency]: science and art are thus wed in the most ideal manner. The “alchemy of tone” will become a favorite occupation for musical discoverers. All the euphonies thus discovered will be fixed, until laws for the construction of genuine consonances and dissonances have been found.46

Both Mager and Busoni transmitted a false image of Cahill’s instrument that reflected their own obsession with microtonality. In building
a means of continuous pitch control into his first electric instrument, Mager meant to follow Cahill’s precedent, but he was in fact creating an entirely new invention, one that sprang directly from his quest for the unlimited “ocean of tone.”

Mager originally called this instrument the Electrophon, but by 1924, he had rechristened it the Spherophone (Sphärophon, from the German Sphäre, “sphere,” and –phon, “sound”). He traced the inspiration for this name to the writings of the nineteenth-century acoustician Johann Heinrich Scheibler, who compared the sound of “pure” harmony (intervals in just intonation) to the “song of the spheres.” The inventor thus positioned his instrument in the long tradition of speculative organology at the very moment that he committed himself to the new and untested possibilities of electric tone production. For Mager, the music of the future, unleashed by new instruments, echoed the timeless song of the cosmos.

ORGANIC INSTRUMENTS

In an article published shortly after his 1926 debut in Donaueschingen, Mager pleaded for aid in the continued development of his instrument: “If the Spherophone is to fulfill the justifiably high expectations it has aroused, it needs its own acoustic laboratory and practice space. Friends of new music, music administrators, acousticians, press, and patrons, help us to attain this, and there is no doubt that something truly great and valuable will emerge!” Mager’s confidence had been bolstered by the encouragement of a number of musical luminaries. Early on he had won the blessing of Busoni, who in June 1922 wrote an impassioned letter to the Swiss conductor Volkmar Andreae asking for 50,000 marks to support the inventor’s undertaking. The money need not be a gift, Busoni wrote—it could surely be paid back with interest in the not-too-distant future. “Think about it,” he wrote. “Old dreams could be realized—similar to those that inspired men to the discovery of flight. Da cosa nasce cosa [out of one thing comes another]—who knows where it might lead?” The prominent musicologist Curt Sachs, professor at the Berlin Academy of Music (Hochschule für Musik), tested the instrument himself and wrote Mager a glowing endorsement.

Alois Hába, the Czech composer and alumnus of the Berlin circle of quarter-tone enthusiasts who founded a department of microtonal music at the Prague Conservatory in 1924, also penned a testimonial for Mager in
which he praised the inventor’s electric instrument and expressed his eagerness to write new music for it.  

Even the characteristically restrained Hindemith was intrigued by Mager’s instrument. Its ability to generate tones of any frequency suggested to him the possibility of creating synthetic timbres through the superposition of pure tones in harmonic proportions. If this effort were successful, he reasoned, all existing musical instruments would quickly become superfluous. Further, Mager’s Spherophone could conceivably be played by mechanical means, thus combining the tonal and timbral possibilities of electric tone generation with the rhythmic and technical potential of automatic instruments. Finally, Hindemith pointed out the economic implications: traditional instruments such as violin and piano were unaffordable for most people, but a Spherophone built to the size of a typical radio receiver—and sold for a similar price—could find a place in every home.

The device that elicited these enthusiastic reactions remained technically quite rudimentary. Mager’s instrument was still monophonic—capable of playing only a single tone at a time—and its timbre could not be substantially varied. Weiskopf compared this “primitive” instrument to the ancient monochord, suggesting that the Spherophone, in its very simplicity, marked a new era of music. Like Mager’s earlier quarter-tone harmonium, the device occupied an ambiguous position between the acoustic laboratory and the concert hall: the inventor himself described the Spherophone as an “experimental tone-differentiation instrument.” But by the time of the 1926 demonstration in Donaueschingen, he had implemented a small but important change to make the Spherophone better suited to live performance. With the addition of a second crank, positioned on the underside of the semicircular plate, the instrument was able to achieve a more conventionally musical transition between tones. Previously, to get from one tone to another, the player had to pass through all the intervening pitches, creating a glissando, or release the button while moving the crank to its new position, introducing a gap of silence. Now the second crank could be moved to the position of the new tone while the first tone was still sounding. By enabling a legato transition between tones, Mager conformed the Spherophone to conventional playing techniques, and thus took a major step toward the mainstream acceptance of his instrument.

A year after the unveiling of the Spherophone in Donaueschingen, Mager showed off his instrument on a much bigger stage, at the
international exhibition “Music in the Lives of the People” in Frankfurt. Here the Spherophone shared the spotlight with the eponymous instrument of the Russian inventor Léon Theremin. Theremin’s instrument, originally known as the Etherophone and later simply called by the name of its inventor, captivated audiences with its “touchless” playing technique, in which the player controlled the tone by moving one hand within an electromagnetic field around a vertical antenna. Like the Spherophone, the Theremin produced an eerie, keening tone that evoked supernatural images in the minds of many listeners. Theremin had first toured Germany in 1923, and he set up a laboratory and residence in Berlin in 1927, where he made contact with the Soviet government agent Georg Julius Goldberg, who assisted him with publicity and filing patents. (As detailed by Albert Glinsky, Theremin’s tour was part of an elaborate effort on the part of Soviet intelligence agencies to gain access to economically advantageous technical information in the capitalist countries of Western Europe.) In Frankfurt, the inventor gave a lecture-recital entitled “New Trails in Musical Creation,” which combined an explanation of his instrument, an introduction to playing technique, and short performances of classical chestnuts arranged for piano and Theremin.

The appearance of the two inventors at the same event provided a field day for journalistic devotees of “electric music,” who produced a spate of articles playing up the contrast between the two men and their instruments. Mager was presented as an archetypical German romantic, idealistic and impractical, while Theremin was depicted as a suave, theatrical showman. But the hints of rivalry between Mager and Theremin overshadowed the commonality of their projects, which went beyond the technical similarity of their inventions. A witness to the Frankfurt exhibition described the hybrid personality of the typical “electro-musician”: “[They were] certainly more than three quarters musician, but through some external circumstance they had ended up in the domain of technology. Delicate, almost hypersensitive natures with many of the marks of Western European decadence—men that one meets almost never in technical professions but very often in the arts.”

The question of whether figures such as Mager and Theremin were at bottom artists, engineers, both, or neither, would continue to occupy both followers and critics of the electric music movement.

Beyond their shared calling as musician-inventors, both Mager and Theremin staked their careers on the claim that electric instruments could be reconciled with the expressive demands of performing musicians.
They and their advocates in the musical press took pains to present these devices as a new kind of humanized, “organic” technology in contrast to the automatic machines of Stuckenschmidt and company. By focusing on the immateriality of electric tone production, they attempted to decouple technology and mechanism and thus accommodate the critiques of mechanical music. Whereas mechanical instruments represented the complete externalization of music from the human being, electric instruments were conceived as technological extensions of the human body; instead of posing an obstacle for musical expression, they enabled direct contact between musicians and their medium. Theremin insisted that his instrument posed no obstacle to the performer’s individual expression and had nothing to do with “automatic technology and soullessness.”

Mager invoked an explicitly biological metaphor to describe the unmediated interaction between the performer and the electric tone: “Through radio-electricity alone is the nerve of music laid bare as through no other means, reacting hypersensitively to the subtlest vibrations of feeling.”

These claims were promptly echoed by the inventors’ allies in musical press. Indeed, many writings on electric music from this period evince a remarkable consistency almost suggestive of a coordinated publicity offensive. In a 1927 article on the Theremin, Heinrich Strobel, editor of the influential modernist journal Melos, wrote: “The player can form
and shape the tone material through the movement of his hands, indeed of his entire body. This is a fundamental difference from mechanical music, in which the dead instrument reigns absolutely. It always produces merely a reproduction of a reproduction, unless one—as has happened—composes for the machine on the basis of its characteristic properties.” For Strobel, the distinction between electric and mechanical instruments was between an embodied, reflexive, “live” technology and a merely reproductive “dead” one. Likewise, the critic Arno Huth declared that with the demonstration of Mager’s and Theremin’s instruments, “once and for all it is proven that instruments making use of electric current for tone generation do not numb and kill aesthetic sensitivity but, on the contrary, allow them in the greatest degree to act more directly than before.” Another critic wrote, “The most important thing about these instruments is not the use of electricity in service of art—that is, the switching on of soulless tones, the purely mechanical mastery of the sound material—but rather, on the contrary, the much more intimate connection of this sound material with the individuality of the performing artist.” The electric instrument, he suggested, is servant and not master. It merely provides the raw material of sound, which is shaped, as ever, by the sensitive touch of the performer: “The tone generation in these instruments is electric, but the playing is artistic, as with every other instrument.” Mager’s former microtonal colleague, the composer Richard Stein, drew a historical parallel, reminding readers that instrumental music, too, was once seen as a “mechanical, soulless imitation of vocal music.” Just as instrumental music had overcome listeners’ prejudices, so too would electric music eventually prevail on account of its expanded technical capacities.

One of Mager’s most outspoken advocates, the journalist Herbert Weiskopf elaborated on this theme, arguing that electric instruments were not only superior to the mechanical devices with which they were often unfairly grouped, they were in fact more responsive to their players’ touch than familiar instruments such as the piano:

The new manner of tone generation through cathode tubes makes the material so pliable that the difficulties that confronted music making in the form of mechanical obstacles to be overcome have been reduced to a fraction of what they are in other instruments. ... Many musicians fear with every improvement of the instrument through mechanical means an encroachment upon inner musical life. This is by no means the case, however dangerous the word electricity may sound to artists. One will readily perceive that this most sensitive of all elements can be influenced through the senses far more easily than the complicated mechanism of a piano. ... Next to the Spherophone,
only singing, the primal ground of all music and its elementary form, would be justified in its existence.\(^68\)

Just as Ernst Toch had compared the aesthetic sovereignty of mechanical music to the sublime autonomy of the singing voice, Weiskopf ventured a counterintuitive convergence of high tech and no tech. Even skeptically inclined critics noted Mager’s effort to “let the machine become a higher organism” and “deliver music from the thralldom of instruments.”\(^69\) Mager’s inventions, though employing the latest technological innovations, promised to transcend materiality and mediation, achieving a directness to rival the inborn ur-instrument of the human voice: paradoxically, sound technology attains perfection in the moment of its disappearance.

**TOWARD KLANGFARBENMUSIK**

Just as he was starting to make a name for himself in German musical circles, Mager set a new technological course for the development of his instruments. In the late 1920s, his focus gradually turned from the microtonal manipulation of the pitch spectrum to the exploration of timbre through electric tone generation. Mager had been grappling for some time with the possibility of using electricity to create new tone colors.
In his 1924 “Radio Prophecy,” he noted that “the Spherophone will be able not only to reproduce the primary timbres of our familiar instruments but will also enable the construction of entirely new, uniquely beautiful tone colors.” At the end of A New Epoch of Music through Radio, written in the same year, Mager speculated that “perhaps the variation of timbre will one day play an even greater role in music than the variation of pitch; perhaps the coming epoch will be characterized not only by the finer division of the octave but also through more perfect melody of timbres.” And finally, in 1926 he explicitly signalled his new orientation when he declared, “Though there are varying opinions on the significance of variegated octave division, there is unanimity in the evaluation of a Spherophone with the most versatile timbral potential. And here great prospects beckon.”

The quest for the compositional control of timbre links Mager’s work not only to the experimental instrument building and idealist musical metaphysics of the nineteenth century but also to the creative approaches to orchestration of composers such as Wagner, Debussy, and Richard Strauss. Although traditional instruments had advanced in many respects to allow the performer an ever greater command of pitch (for example, valves on brass instruments and equal temperament on keyboards) and volume (the steel-frame grand piano), the timbre of a given instrument was essentially hardwired and thus largely closed off to compositional design and performative gesture. For Mager, the manipulation of timbre thus represented the final frontier of instrument building, a problem to which electric tone generation offered the ideal solution.

One of the earliest and most influential attempts to subject tone color to techno-scientific discipline was found in Hermann von Helmholtz’s 1863 treatise On the Sensations of Tone. In order to demonstrate how timbre could be artificially generated and controlled, Helmholtz built an apparatus consisting of a set of tuning forks tuned to the harmonic spectrum of a low B-flat. Each fork was placed between the two poles of an electromagnet and in front of a tube-shaped resonator that amplified its otherwise quiet tone. When the electromagnets were charged, the tuning forks were set into continuous vibration, their relative volume adjusted by partially covering the cavity of the appropriate resonator. Helmholtz described how he could use this device to construct artificial timbres through the carefully calibrated superimposition of individual sine tones. His primitive additive synthesizer was designed to facilitate the scientific understanding of timbre through the experimental
reconstruction of the vowel sounds of human (specifically, German) speech, but its method of tone production could also be employed to generate unique, unheard-of timbres. By isolating timbre as a distinct aspect of sound, Helmholtz demonstrated that tone color was scientifically manipulable, as opposed to God-given and inalterable.

The musical implications of Helmholtz’s timbral experiments were recognized even before the turn of the century. An anonymous article published in the *Journal of Instrument Building* (*Zeitschrift für Instrumentenbau*), signed only “Technician,” explained in 1887:

To the means music provides for the expression of artistic feeling [i.e., melody, harmony, rhythm, and dynamics], there belongs yet another, which, if it can be freely mastered, will become the foremost: sound [Klang]. Indeed, we already know the magic of timbre, which is to music what color and complexion is to painting. But how poor are our current means of calling forth sound in its infinite richness—and why? Because our technical means are insufficient. We know from Helmholtz how sound comes into being, that it owes its existence to the simultaneous sounding of many tones, and we can conclude from this that the timbral element must surpass by far the other elements in terms of richness and inexhaustibility. But as long as we are forced to make use only of the few sounds that we can incidentally create, instead of freely combining tones of any number into sounds, this treasure remains closed to us. [. . .] For we are able to change the mechanical relationships that determine the emergence of tones and overtones only to a limited extent, and not in the rapid alteration that would be demanded by the art of sound; and as long as we lack the means to create tones of any number and volume, the beauties of sound will remain unattainable. The possibility of such a free mastery of tone generation seems to rest upon the use of electricity in the creation of tones, and when we perceive in the example of the telephone how electricity makes possible the reproduction of so many sonic variables, our hope for the free mastery of sound must naturally affix itself to electricity. [. . .] The free generation of sound appears enabled by electricity, and with the application of electricity in music this art will enter into an entirely new phase of development.74

While the technical possibility of electrically generated tone-colors was known in the late nineteenth century, the aesthetic motivation for such a technique would emerge a bit later. In a speculative passage at the end of his 1911 *Theory of Harmony*, Schoenberg had suggested the possibility of creating successions of tone colors that possessed the same kind of musical logic that connected the pitches of a melody—a prospect he gave the name of *Klangfarbenmelodie* (tone-color melody). Such a technique, Schoenberg suggested, though perhaps merely a “futuristic fantasy,” would prove capable of “heightening in an unprecedented
manner the sensory, intellectual, and spiritual pleasures offered by art” and would “bring us closer to the illusory stuff of our dreams.” Schoenberg’s idea followed logically from the well-established acoustic principle that timbre is largely a product of the frequency relations projected in the overtone spectrum of a given tone. Accordingly, Mager’s shift in focus was not as radical a reorientation as it might first appear: from the subtle relations of pitch between tones, it was an intuitive transition to the microcosmic world of frequency ratios within a single musical sound—the “alchemy of tone” that creates what is perceived as timbre. The idea of the spectrum was simply extended from pitch to timbre, from tuning to tone color. This implication, too, lurked in Schoenberg’s radical reinterpretation of the relationship between pitch and timbre: challenging the conventional notion that these were two independent parameters of musical sound, he suggested that tone color was the primary factor, of which pitch was simply “timbre measured in one direction.” Mager quoted this passage at length in A New Epoch of Music through Radio.

For Schoenberg, Klangfarbenmelodie had nothing to do with creating new timbres; rather, it was essentially a novel approach to orchestration. In adopting the concept, which he gave the more general name Klangfarbenmusik, Mager thus joined two distinct ideas: the creation of original tone colors by means of electric tone generation and the manipulation of these timbres guided by an as yet inchoate compositional discipline. In light of such prospects, the inventor concluded, “Whoever has occupied himself even a little with electric sounds will be forced to the conclusion: there are yet things in music of which our musical book learning cannot dream.”

In his report from Donaueschingen, Herbert Weiskopf had portrayed the Spherophone as an advance on Helmholtz’s tuning-fork synthesizer, arguing that while that device was of “merely physical significance,” Mager’s instrument represented a genuine solution to the problem of timbre composition. Although this contrast is telling for the technological lineage it established, it was inaccurate in a technical sense: Mager’s approach to shaping electric sound was entirely different from Helmholtz’s. Guided more by intuition and experiment than by scientific rigor, he used two distinct (but compatible) methods of controlling timbre on an empirical basis. The first technique was to affix plates of various shapes, sizes, and materials to loudspeaker drivers to obtain new tone colors. The resonant frequencies of these objects interacted with the harmonic spectrum of the electrically generated tones to create novel
and unpredictable timbral effects. An account from the early 1930s describes the scene in Mager’s electroacoustic studio:

Instead of organ pipes, there is an odd collection of objects assembled behind a screen: large sheets of iron hanging from frames, square panes of glass, and wooden panels of the most varied provenance. These are the loudspeakers. [. . .] Earlier, Mager had used typical over-the-counter speakers. But with his increasing knowledge, he began to gather membranes of astoundingly varied sonic character, sought explicitly for his purposes. Glass sounds different than wood, hanging sheet metal different than an electrically excited gong.  

Mager’s assistant Oskar Vierling reported that the inventor would even fasten loudspeaker drivers directly to the bodies of musical instruments such as violins in order to create an electric hybrid of the instrument’s tone.  

Mager explained his use of metal plates as resonators in a 1932 patent: the plates are shaped so as to resonate not only to the fundamental tone but also to the harmonics above that tone. This creates a subtle echo—what we might now call “reverb”—after the sound from the loudspeaker subsides, which confers upon the tone (in Mager’s words) a “peculiar spatial effect.”  

The second means of controlling timbre was to apply electric filters to sculpt a harmonically rich sound by blocking out frequencies above or below a designated level. This technique was pioneered by the engineer Karl Willy Wagner (1883–1953), whom Mager encountered at the Telegrafentechnischen Reichsamt (Reich Office for Telegraph Technology), where Wagner was president from 1923 to 1927. Wagner’s experiments with electric filters represent some of the earliest applications of what would later be known as subtractive synthesis. He developed two kinds of filters, which attenuated frequencies above and below a designated cutoff point. Wagner noticed that if a low-pass filter is applied to a violin tone, the sound loses its characteristic timbre and resembles that of a flute. With high-pass filters, on the other hand, one can create timbres in which the lower partials are attenuated or cut out altogether. Because periodic tones typically have a greater accumulation of energy (volume) at the lower end of the frequency spectrum, a high-pass filter allows for the creation of timbres whose structure is in direct contradiction to the natural acoustic tendency of higher overtones to decrease in volume.  

Sounding a familiar theme, Wagner was struck by the unearthly timbres that resulted from his electroacoustic manipulations: he noted the “odd musical charm” of sounds processed by the high-pass filter and remarked that “a melody played with these tones sounds peculiar, as if
it came down to us from distant spheres.” For Wagner, as for many other listeners, electrically generated sounds evoked not technological images of spinning cogwheels or atomic particles but rather scenes of distant places, whether an exoticized Far East or other dimensions of space. Even those outside the charmed circle of electric music enthusiasts were susceptible to such reactions: in a 1927 article published in the generally conservative *Zeitschrift für Musik*, the author gushed over the instrument’s “sound-clusters of immediately mystical effect” and declared that “with Mager’s invention, the ancient oriental dream of a *music of the spheres* has become a reality, for entry to the tonal possibilities of the cosmos now stands open.” (The otherworldly resonances of electric sound can be traced at least back to Busoni, who called Cahill’s Telharmonium a “transcendental tone generator”—when it is played, “the room is magically filled with sound, a scientifically perfect, never malfunctioning sound, invisible, effortless, and unremitting.”)

While most of Mager’s timbral experimentation involved modifying the harmonic spectra of stable periodic tones, he also delved into the domain of unpitched sounds and imitative effects. In one of his earliest patents, filed in 1925, Mager stated that the electrical components of the Spherophone could be configured to produce the “imitation of elementary sounds,” such as birdsong, wind, and the splashing of water. He claimed that the noises and sound effects created by his instruments were much sought after by producers of radio, film, and theater, and a reviewer likewise noted the instrument’s aptitude for background noises (*Geräuschkulisse*) such as the clatter of dishes, footsteps, and engine and machine sounds, as well as its capacity for “comic noise symbolism,” exemplified by vocal expressions such as yawns and snores.

But Mager’s use of noises wasn’t limited to such straightforwardly mimetic effects. Hidden away in his later patents are techniques that straddle the boundary between the imitative reproduction of familiar sounds and sonic experimentation of a more speculative nature. In one of his patents from this period, Mager describes how tone color could be periodically altered by the filtration of high or low frequencies, creating an “entirely novel” pulsating contrast between bright and dark or sharp and dull. This procedure of enlivening timbre through controlled periodic motion helps clarify Mager’s otherwise mystifying references to “timbre trills” and “timbre vibrato.” What Mager meant by these terms is not entirely clear, but it seems likely that these involved the modulation of the filter cutoff frequency by a sine or square wave, in analogy...
An even more radical technique is found in a 1932 patent in which Mager described an “apparatus for the generation not of music but of noise.” In this configuration—which, like many of the innovations described in Mager’s patents, was apparently never developed beyond an experimental stage—several electrically generated tones are modulated by an inaudible low-frequency oscillation. Because of the nonlinear nature of human hearing, adjusting the frequency of the modulating tone changes the frequencies of the four tones and their proportional relations to each other; for example, an increase of 200 hertz applied to all four tones will result in a different perceived intervallic shift for each. Mager describes a scenario in which four low tones in a very narrow frequency range create the sensation of rolling or rumbling through the beating of their vibrations. As the modulating frequency is increased, the sound changes from a rattling to a hissing. If the modulated tones lie in the middle range, the sense of definite pitch is lost; if they are very high in pitch, a slight alteration of the modulating tone creates a chirping sound, and a wider variation creates a sound like that of the howling of the wind. In his patent application for this technique, Mager declared, “Here lies the transition from sound to noise.” Such experiments went beyond the domain of Klangfarbenmusik to what Mager explicitly called “noise music” (Geräuschmusik), a phenomenon that he may have been the only one to hear.

Mager’s Magic Organ

At the time of Mager’s 1927 demonstration in Frankfurt, his instrument was in a state of flux. In the exhibition’s Spherophone Room, the inventor showed off no fewer than three distinct models: a Melody Type operated by a handle (corresponding to the original design), a Chord Type consisting of a panel with an array of buttons that sounded various harmonic intervals, and a Tone-Color Type, called the Kaleidophone, devoted to the manipulation of timbre and played from a conventional musical keyboard. Mager’s diverse musical interests had been parceled out into three distinct, highly specialized instruments. But of this trio, all but the last would soon be discarded: Mager’s emerging focus on the electroacoustic manipulation of timbre—not to mention the difficulty of developing three instruments at once—led him to concentrate his attention on the new keyboard-operated model.
The outward form of the new instrument was strikingly conventional. While Mager’s previous constructions could be mistaken for laboratory apparatus, the new model resembled the console of a pipe organ, with two keyboard manuals, a pedal board, and a bank of switches and knobs to control the tone color. Unlike the heterodyne-based beat-frequency oscillator of his earlier instrument, this new device generated audible tones through the feedback method earlier explored by radio engineers such as Armstrong and de Forest. Mager eventually dropped the name Kaleidophone in favor of Klaviatur-Sphärophon (Keyboard Spherophone), thus creating a nominal link with earlier models, in spite of the new design. The adoption of a conventional keyboard allowed him to redirect the player’s attention from the instrument’s interface to the shaping of electroacoustic tone color. This keyboard-centered design—which inspired talk of an “electric organ” in the press—would remain the basis of Mager’s instruments from this time forward.

In spite of the instrument’s new look, Mager had not abandoned his earlier microtonal ideals; rather, he had discovered a way of reconciling the production of microtones with the conventional keyboard interface. This was a device he called the musical pantograph (*musikalischer Storchschnabel*), a name borrowed from the V-shaped drafting device that connects a handheld pen to a second writing apparatus, allowing drawings to be duplicated automatically as the second pen copies the motions of the first. By adjusting the angle of the mechanical connection, the duplicated drawing can be made larger or smaller than the original. Analogously, the musical pantograph adjusted the capacitance of the sound-generating circuit so as to alter the musical intervals sounded by the instrument’s keyboard. For example, if the interval of a tritone were “stretched” to span from one C to the next C above it, each adjacent key would sound a quartertone interval, instead of the usual semitone. Thus, the familiar gestures of keyboard technique could be mapped onto a new, electrically altered pitch space. The interval spanned by an octave on the keyboard could be made as small as a major second, so that each successive step on the keyboard represented an interval of a twelfth tone, resulting in a scale with 72 distinct pitches in each octave. In spite of the potentially radical compositional implications of this device, it was still a “fixed-tone” tuning, in contrast to the earlier Kurbelsphärophon and the Theremin. Mager had not given up on microtonality, but he had abandoned the free-floating glissando characteristic of the first generation of electric instruments.

Mager presented his new instrument in Darmstadt on October 6, 1928, at the yearly convention of the Reich Association of German
NOTENBEISPIELE
zu dem Aufsatz: NEUE ELEMENTE DER MUSIKERZEUGUNG
von Hans Kuznitzky in MELOS VI/4 (Aprilheft).

Notenschrift für 72-Teilung der Oktave

Jörg Mager

Beispiel für „Nacheinander“ von Viertel- und Halbtönen

$\uparrow = \text{Schrägrich bedeutet } +\frac{1}{4}\text{Ton}$

aus „Abend am Meer“
von Jörg Mager

Viertelton — „Terrassen“ (Abstufung in $\frac{1}{4}$ T.)

Modulation von $C$ nach $C\uparrow$ (Hoch-e)

Modulation von $B$ nach $B\uparrow$

Musicians and Music Teachers (Reichsverband deutscher Tonkünstler und Musiklehrer), one of the oldest and largest professional organizations for musicians in Germany. He followed his “Demonstration of Electric Music” with a plea to the assembled musicians and professors, in which he depicted the dismal conditions of his makeshift studio in Berlin and stressed his need for more favorable working conditions. The fate of electric music, Mager declared, hinged on the emergence of patrons to support its development. His appeal apparently found a sympathetic audience: just months after his demonstration, he received an unprecedented offer of institutional backing. In order to further Mager’s research, but also “to create for German genius, German perseverance, and German selflessness the role in the world that they deserve,” a cadre of influential residents of Darmstadt joined forces to found the Society for Electroacoustic Music (Gesellschaft für elektro-akustische Musik) in January 1929. Mager signed a three-year contract that required him to take up residence in the city and stressed the “industrial exploitation” of his inventions but otherwise accorded him broad creative liberties. With the support of the Society, Mager was able for the first time to focus his energies exclusively on the development of his instruments. While he had previously cobbled together a living from intermittent school-teaching duties and stipends from a patchwork of government agencies, he was now guaranteed a generous yearly income. In addition, Mager was provided with an able staff of assistants and allowed to live and work in the Prinz-Emil-Schlößchen, a stately rococo manor constructed in the late eighteenth century. Here Mager would set up his “Electro-Music Laboratory,” one of the first of its kind in the world.

On August 25, 1930, Mager presented the first fruits of this new partnership to an audience of invited guests in Darmstadt. The latest model of his instrument was in essence an expanded version of the earlier Keyboard Spherophone, now equipped with three manuals and a pedal board for a total of four voices. Mager rechristened the instrument the Partiturophon, from the German Partitur, meaning “musical score”: just as a score contained multiple parts, the instrument could play several independent lines, each with its own distinctive timbre. An account of Mager’s demonstration—which featured arrangements of works by Bach, Beethoven, Wagner, and Mendelssohn—noted on the instrument’s “overpowering” and “compelling” effect, which transported listeners to a “new, unsuspected, almost supernatural musical realm.” Among the audience members who witnessed the unveiling of the Partiturophone was the prominent conductor and champion of
modern music Hermann Scherchen, who penned an extensive report on Mager’s new instrument. Although noting shortcomings such as the lack of convincing brass and string timbres and a certain tonal monotony throughout its various registers, Scherchen offered a vigorous endorsement of the latest model. The instrument was far more welcoming than earlier versions: it could plug into any domestic electrical socket, and its keyboard interface would be familiar to most musicians. He also marveled at the Partiturophone’s microtonal possibilities, its wide dynamic range, and its rich spectrum of “electro-tone timbres.” In particular, Scherchen called attention to the instrument’s potential for Klangfarbenmusik through the juxtaposition of four different tone colors, each of which can be varied continuously during the course of a passage. He declared Mager’s instrument “entirely ready for artistic musical purposes.”

Other press accounts concurred, judging the Partiturophon fit for mass production.
The introduction of the Partiturophon in Darmstadt marked Mager’s arrival as a musical celebrity. He was celebrated in the press as an eccentric genius and creator of a “magic organ.” He received illustrious visitors in his Darmstadt laboratory, including the Grand Duke Ernst Ludwig of Hessen, who presented the inventor with a valuable silver plate to use as a loudspeaker membrane. Mager’s ascent into the heights of German musical culture was marked by two remarkable commissions in the early 1930s. First, he was asked by Winifred Wagner (Richard Wagner’s daughter-in-law) to provide the sound of the “Grail bells” for the 1931 Bayreuth production of Wagner’s last opera, Parsifal. The score calls for four low notes, which were traditionally played on huge bells or other metallophones. Because these couldn’t fit in the orchestra pit, the ringing of the bells was typically coordinated by a team of performers using an elaborate system of cues. Mager’s use of electrically excited metal plates, controlled from a keyboard by a single player, won widespread approval and sparked the interest of such luminaries as Arturo Toscanini and Oswald Spengler. The following year, Mager was invited to provide electric music and sound effects for performances of Goethe’s Faust in Frankfurt and Darmstadt as part of the nationwide festivities marking the centenary of the poet’s death. As he describes it, Mager’s musical contribution was not simply a naturalistic accompaniment to onstage action; instead, he sought to match the magical tenor of the play with the otherworldly sounds of his instrument: “In the prologue the sun intones in the old way with an ethereal, oscillating vibrato. The growling of the poodle is accompanied by microtones. For Walpurgis Night there is ghostly, demonic, eccentric music. The howling of the long-tailed monkey is created by powerfully vibrating metal membranes.”

At the start of the 1930s, Mager’s career had reached a plateau hardly imaginable a few years earlier. But while his role as pioneer of electric music had been largely uncontested since his public debut in 1926, he soon found himself in the middle of a crowded field. Toward the end of the 1920s, a wave of new electric instruments began to appear not only in Germany but also in the United States, France, and the Soviet Union. Mager’s most formidable domestic challenger would be the Trautonium of Friedrich Trautwein, which was unveiled just months before Mager’s Partiturophone. The emergence of the Trautonium and the development of Mager’s instruments during the 1930s will be examined in chapter 5.

Perhaps even more troubling than the growing field of competitors, however, was the absence of original compositions for the new
instruments. Early in his career, Mager had acknowledged the necessity of music as a proof of concept: “How often have I already heard, ‘Simply play something beautiful, [and] that would convince us more than pretty words and the most seductive theory of your music of the future!’” But four years after the public debut of the Spherophone, Mager’s instruments still lacked even the rudiments of an original repertoire. Early expressions of interest from composers such as Hindemith and Hába had come to nothing, and no others had stepped up in their place. In lieu of idiomatic original works, Mager presented a kind of electric music variety show: surviving accounts of his demonstrations give the impression of freewheeling, quasi-improvisatory displays of the instruments’ technical capabilities, buttressed by set-piece arrangements of canonic classical works. (Beethoven’s Moonlight Sonata seems to have been a favorite.)

The discrepancy between electric music’s lofty promises and its modest results was widely recognized by both advocates and detractors. For the time being, however, awareness of this problem did little to dampen the zeal of the movement’s supporters. Remarkably, even without original compositions, Mager was able to convince composers, journalists, and—most importantly—funders of his instruments’ potential. Untroubled by questions of audience or repertoire, Mager focused his attention on his inventions, seemingly led by the assumption that practicalities would be resolved of their own accord once the instruments were perfected.