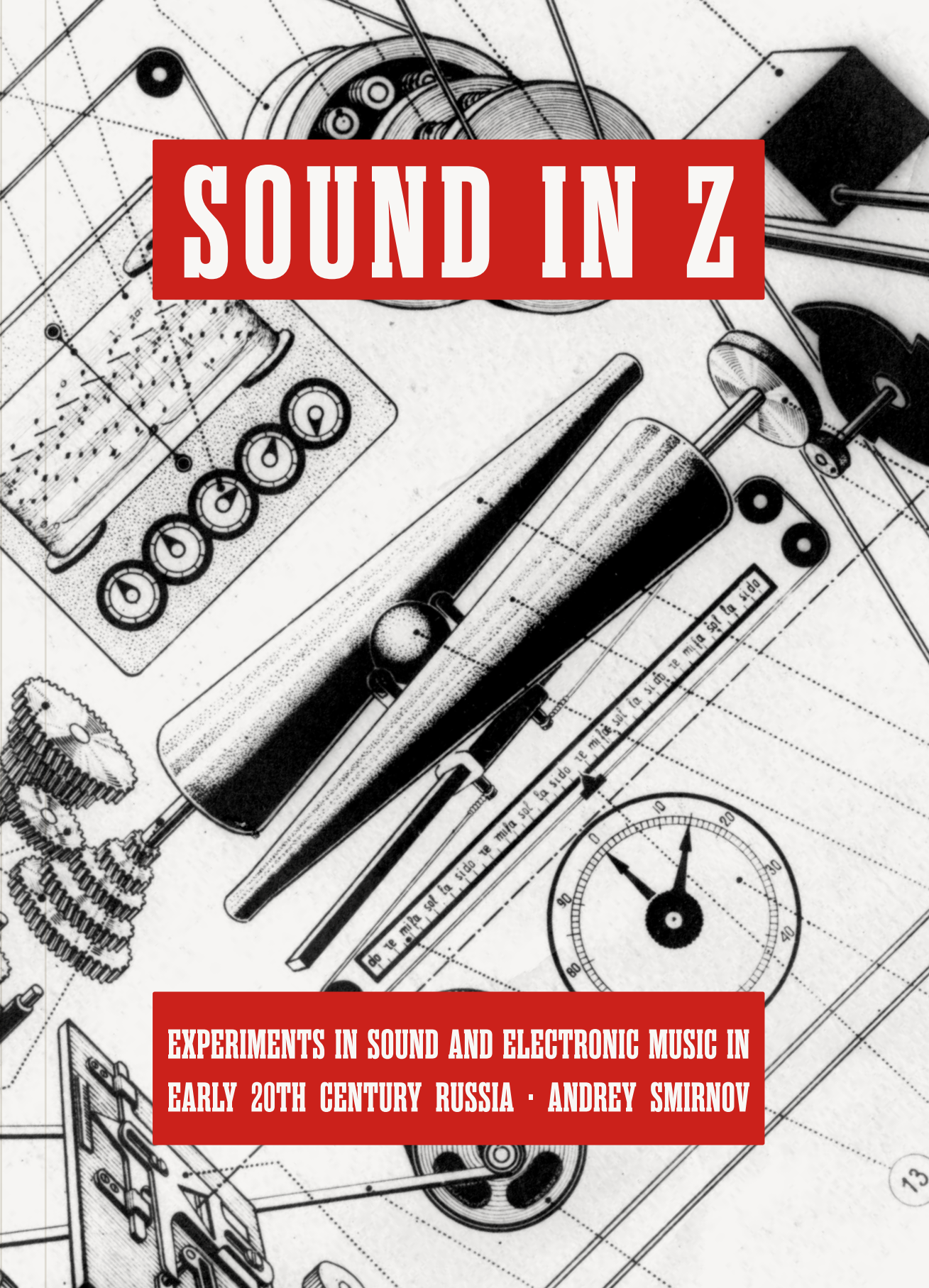
SOUND IN Z



EXPERIMENTS IN SOUND AND ELECTRONIC MUSIC IN EARLY 20TH CENTURY RUSSIA · ANDREY SMIRNOV

Inside front cover image: The *Symphony of Sirens*. Performance in Moscow, 7.11.1923.
René Fülöp-Miller, Geist Und Gesicht Des Bolschewismus. Amalthea-Verlag, Vienna 1926.

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Experiments in Sound and Electronic Music
in Early 20th Century Russia

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Bannikova was designed at Polygraphmash type design bureau in 1946-51 by Galina Bannikova, inspired by Russian Grazhdansky early- and mid-18th century typefaces as well as Roman Humanist typefaces of the Renaissance. The revised, improved and completed digital version was designed at ParaType in 2001 by Lyubov Kuznetsova.

Sound and Music

Supported by
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We dedicate this book to Mikhail Khodorkovsky,
and all victims of the ongoing political reprisals in Russia,
all those who are strong in spirit, who believe in the value of an open society,
striving for democracy, knowledge, intellectual honesty and integrity,
resisting dictatorship, lies, cynicism, violence, obscurantism and
ignorance, even at the cost of their own freedom.

Moscow, August 2012

FOREWORD

This publication offers an introduction to Russia's contribution to the birth of electronic music, sound synthesis and audio technology in the early 20th Century. It is a story of politics and power, of the institution and the avant-garde, of collaboration and personal achievement, of ambition, opportunity and oppression. It is a story of remarkable personalities, curious inventions, astonishing performances, radical ideas, complex mathematics, pioneering electronics, engineering, design and experimentation. It is also a story of patents and funding applications, of success and failure, support and rejection, optimism and disillusionment, hunger and poverty.

It is a story of which only fragments are known, not only in the West but also within Russia itself. Increased interest in this area in the past two decades — not least in the life and work of Leon Theremin — has seen more scholarly research in the field. *Sound in Z* makes a valuable contribution to this revival of interest and is intended as a catalyst for further academic research. Consequently, much visual and textual material featured here has rarely — if ever — been seen either in print or in English before.

Andrey Smirnov has devoted much of his professional and personal life to researching this field. His passion, enthusiasm and devotion to the subject are clear to anyone who meets or works with him. Beyond this, though, there is a sense that Smirnov has a real affinity with the protagonists of this story, the Russian men and women who contributed to the early development of electronic music and sound synthesis — it is almost as if he is one of them, just from a different time. His knowledge and expertise, both in terms of understanding the technology and of researching the wider history, have been crucial not only for this publication, but for his life-long endeavours to bring the material to light and into the international critical arena. As Director of the Theremin Centre at Moscow State Conservatory, Smirnov has worked tirelessly to develop and to explore the Centre's archives, as well as in innumerable other libraries, museums and private archives, even tracking down living descendants in his quest to unearth new archival materials. Smirnov's own personal collection and library have been equally invaluable to the research presented here.

This publication is the result of a combination of factors and circumstances. Smirnov has curated, co-curated and contributed to a number of exhibitions and catalogues about this field in recent years, one key event being the *Sound in Z* exhibition at the Palais de Tokyo in Paris in 2008-9, which was part of a series of exhibitions developed under the banner of 'From One Revolution to Another — Carte Blanche to Jeremy Deller'. At the invitation of Jeremy Deller, and co-curated with Matt Price with assistance from Christina Steinbrecher, it was through this exhibition that a partnership was formed between Sound and Music, the UK's leading agency for contemporary music and sonic art, and arts publisher Koenig Books, London, which enabled this publication to happen. Richard Whitelaw and David Rogerson of Sound and Music, and Franz König of Koenig Books, London, enthusiastically agreed to support a publication of Smirnov's research.

Much interesting and significant material from history doesn't ever come to light, is forgotten or overlooked, whether for political or financial reasons, because stories are not well documented or simply because they are just not heard by the right people at the right time. A lot of material from the first half of the 20th Century was actively destroyed or written out of the history books as it did not fit within the Stalinist regime's vision of what sound and music technology should be. Smirnov has been piecing together many of the interconnected strands of research by key figures of the period, many of whom fell out of favour with the authorities, or were even sentenced to death for their work. It is to be hoped that their stories and research are given renewed attention as a result of *Sound in Z*, and that Smirnov's own contribution to the field also receives the recognition it deserves.

Jeremy Deller and Matt Price

fig I Meeting in June 2008 at the Theremin Centre, Moscow State Conservatory, in preparation for the exhibition *Sound in Z* at the Palais de Tokyo, Paris. From left: Christina Steinbrecher, Liubov Pchelkina, Jeremy Deller and Andrey Smirnov. Photo: Matt Price.

PREFACE

This book is an attempt to put into the public and scholarly arenas some ideas and lives from early 20th Century Russia that haven't necessarily seemed connected before, exploring cross-connections between various music and audio technology inventions and the destinies of those who created them, the hopes these people had for their research and discoveries, and the often disillusioning realities and fates that befell them. It is, in many ways, a story of utopias and anti-utopias, of the avant-garde and the institution, of genius and bureaucracy, of intellectual freedom and totalitarianism. The material contained within the book defies many traditional views of what is relevant for the discourse of music culture by including such seemingly distant subjects as the scientific organization of human labour, espionage and space exploration. It is an attempt to sketch a map both for myself and for future researchers as it is a subject on which there remains a vast amount of under-researched and as yet undiscovered material. As such, I consider this publication as merely a beginning and a platform for further research within the field.

A significant proportion of the publication is based on Russian texts that have never previously been translated into English, and are largely unknown in Russian. In many cases I would have preferred to give the reader an opportunity to access the text rather than my interpretation of it, but it is a complicated task due to the number of unusual Russian neologisms popular in the 1920s and related difficulties in translation.

There are several important topics that fall just beyond the scope of this book. One of them relates to the history of the relationships between the pioneers of sound technologies (the majority of whom were artists, poets and scholars) and the academically educated composers, such as Alexander Scriabin, Leonid Sabaneev, Nikolai Roslavets, Alexander Mosolov, Sergei Prokofiev, Dmitry Shostakovich, Ivan Vyshnegradsky and so on. Unfortunately, though with the notable exception of Amy Nelson's *Music for the Revolution: Musicians and Power in Early Soviet Russia* (Pennsylvania State University Press, 2004), this subject is poorly documented. It demands considerable further research and archival work, especially within private correspondence. It's clearly a topic for future publications.

Another important theme that is all but absent in this publication is the wide variety of artistic experiments, highly popular in the 1910s and 20s, that explored synaesthesia — the interaction of the senses — in the genres of visual music, audiovisual art, etc. Research and experiments were developed by numerous artists and scholars including Alexander Scriabin, Leonid Sabaneev, Nikolai Kulbin, Konstantin Saradjev, Mikhail Matyushin, Solomon Nikritin, Sergei Eisenstein and many others. Although this subject is well documented, there remains much research still to be done and it would be worthy of a book in its own right.

Yet another topic in need of development beyond these pages is related to social sciences. Ideological totalitarianism in Soviet Russia started growing rapidly after 1925 and put an abrupt and undisputed end to all truly revolutionary developments in the arts and related scientific research. It resulted in a devastation that characterized these fields during the Soviet and post-Soviet era, right up until the end of the millennium and beyond. *Sound in Z* offers a wealth of material to reflect on the sources of the avalanche of creativity in the anarchical 1920s, and the reasons why it was never repeated during the following totalitarian and authoritarian regimes. Although there was a splash of creativity during the short period of liberalization in the 1960s, it has never happened again since, not even during Perestroika in the late 1980s.

Andrey Smirnov

TREASURE HUNTERS OF THE 1920s

Russia is the country-riddle,
With an essence that has not yet been shown,
With enormous potential that has not been developed to its end,
With an eternally delayed happy ending,
As if a spiritual homeland for all 'treasure hunters',
Their Promised Land.

Sergei Kornev[1]

How important is the talent and creativity of a single person in the development of the society to which he or she belongs? The exploration of Russian culture between 1910 and the end of the 1930s offers innumerable examples in answer to this question, with story upon story of individuals who made remarkable personal contributions to science and the arts. It was a time of complex and inconsistent social and political movements synonymous with the epoch. Living in famine, extreme cold and poverty, creative people were dreaming about the future country, where everything would be *different* — a perfect man, a universal language, *real* machines.

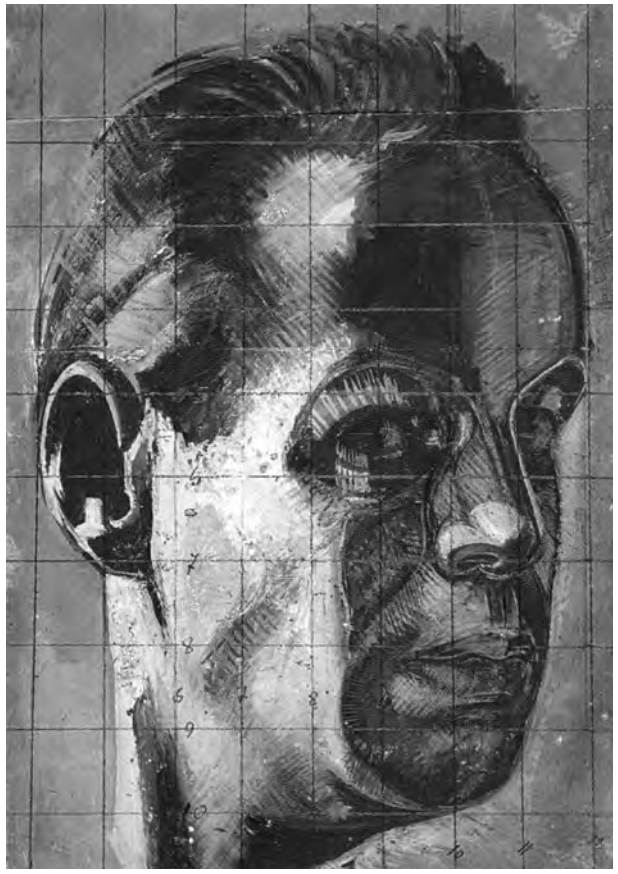
Russian philosopher Lev Gumilev has described the people who drive mankind into the future as 'passionaries'. Many of the figures included in this publication might be described as constituting 'Generation Z' — ingenious, creative people trying to move forward during a period of great transformation.

Why Generation Z? The dissemination of the electrical current and the proliferation of radio waves bewitched and delighted the Russian public, who responded to it with an almost religious fervour. These and other technological phenomena became the inspiration for widespread cultural activity. The Russian Futurist Velimir Hlebnikov asserted: 'Radio has solved a problem that the Temple as such has not solved... the problem of joining the uniform soul of mankind to a uniform daily wave... This problem is solved by means of lightning.'[2]

The letter Z is in many ways emblematic of the period. Z is for zigzag, the spark; it is the symbol of energy, of radio transmissions, of electrical charges and of lightning. It became ubiquitous on book covers, posters and in paintings during the 1920s. At the same time it is evocative of the anarchical, adventurous ideas and projects that occurred during this period and that would have been inconceivable in other times — projects that were often anonymous and many of which have largely been forgotten.

1 Kornev, S. 'Kladoiskateli' (The Treasure Hunters), 2002. Web magazine *Kitezh*, http://kitezh.onego.ru/treasure.html. Trans. AS.

2 Hlebnikov, V. 'Radio budushego' (Radio of the Future), 1921. In the collection *Tvorenia*, Moscow, 1986, p.637. Trans. AS.



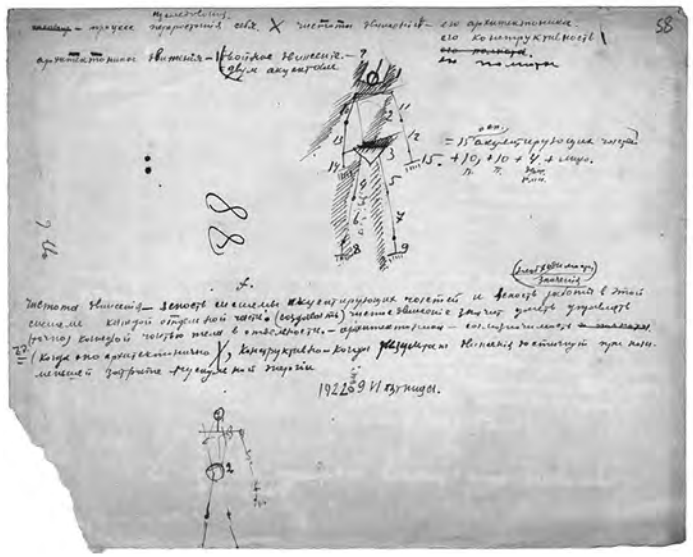


fig II Solomon Nikritin. A self-portrait. c. 1930. As with most of Nikritin's works, this painting is a part of the analytical research into form and techniques he was developing in the 1920-30s. Published: Pchelkina, L. 'Solomon Nikritin — "hudozhnik processa". Neizvestnie stranici Russkogo Avangarda 1920 godov'. *Dekorativnoe iskusstvo i predmetno-prostranstevennaya sreda*. Vestnik MGHPA, part 1, 1/2012. p.89.

fig III Solomon Nikritin. Draft manuscript. 1922. Russian State Archive of Literature and Art (RGALI).

In the aftermath of the October Revolution[3] both society and the State looked to religious values and bourgeois idealism to fill the vacuum that had been left by the overthrow of the Tsar. The ideology that emerged desired a new kind of art based primarily on materialism, natural science and formal analysis rather than on abstract emotions or subjective taste — it was an objective, rationalist agenda with a scientific and technological approach to the arts. At the same time the culture of the early 20s was very much based on principles of anarchy. In 1917–21 the traditional Russian State was almost ruined and society became structured as a sort of anarchical 'network culture', based on numerous cross-connected 'creative units' — artists, scholars, politicians and so on. In 1918 the Federation of Futurists declared: 'Separation of Art from the State. Destruction of political control over Art. Down with diplomas, ranks, official posts and grades. Universal Artistic Education.'[4] This artistic Utopia was coexisting with the brutal policy of War Communism, conducted by the state during the Civil War and replaced with the NEP (New Economic Policy) in 1921, when socialist approaches were combined with possibilities of free enterprise. Although Lenin hated 'futurists' (after the revolution he extended this name to almost all avant-garde artists), at the same time he suffered them. Therefore a unique opportunity arose: the State was keen to encourage art that broke with traditions and that was being developed in entirely new ways. Representatives of the government, including Anatoly Lunacharsky and Leon Trotsky approved highly experimental projects, encouraged freedom of the creative community, and supported the so-called Left. Hence they were receptive to the most recent trends in art and, for a while at least, were champions of the avant-garde. Their primary intention was for this new art to bring about a cultural context in which a new generation of Russians could be nurtured who would be worthy of the title 'the Man of the Future'.

In October 1918 Lunacharsky, the people's commissar of enlightenment, officially proclaimed that the arts should be developed on an experimental basis.[5] As he told the composer Sergei Prokofiev: 'You are revolutionary in music as we are revolutionary in life — we should work together.'[6] New ways of hearing and viewing became an integral part of the new outlook permeating society. Artists, poets, musicians and architects rushed enthusiastically into the new reality, studying physics and mathematics, embracing sciences concerning the nature of light and sound, and developing theories about what became known as 'the Art of the Future'. Many were inspired by the analytical minds of the Renaissance.

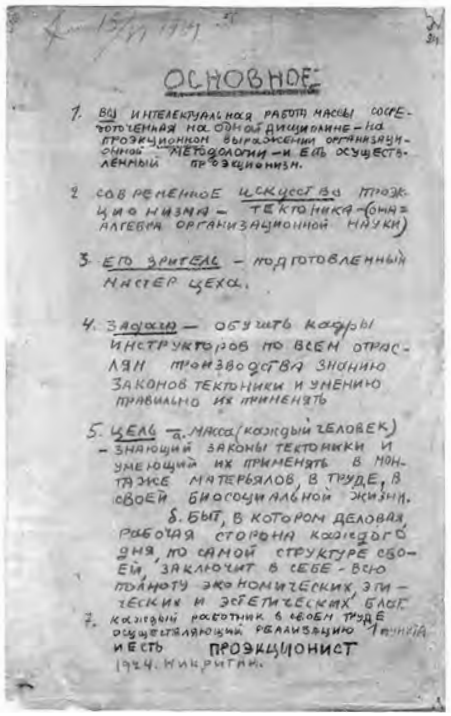
New artistic groups were founded or were able to grow, united by the motivation of bright individuals rather than by a common agenda. All manner

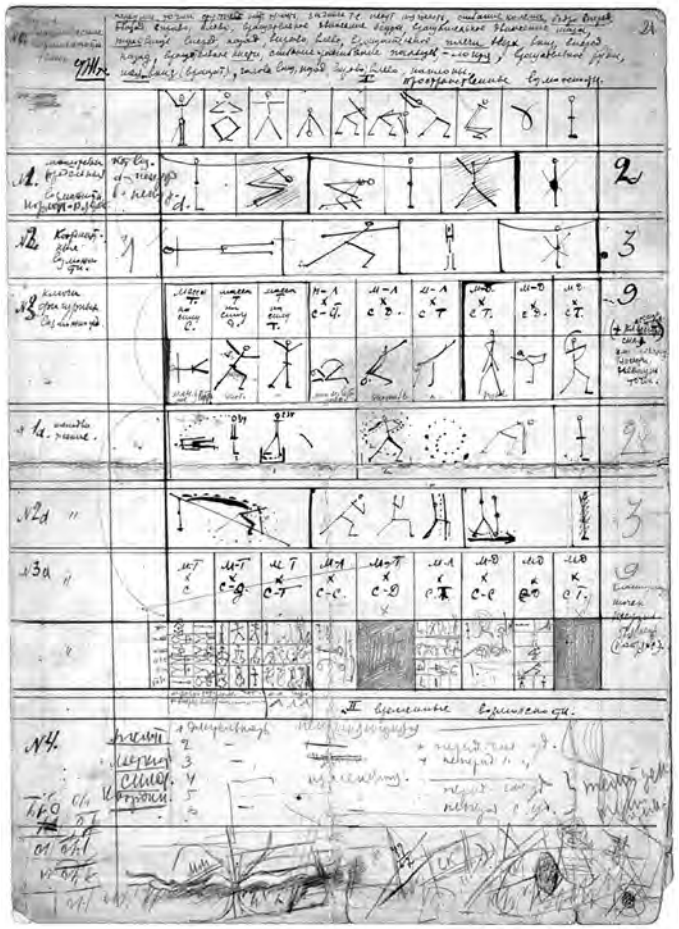
3 The Russian Revolution is the collective term for a series of revolutions in Russia in 1917, which destroyed the Tsarist autocracy and led to the creation of the Soviet Union. The Tsar was deposed and replaced by a provisional government in the first revolution of February 1917 (March in the Gregorian calendar; the older Julian calendar was in use in Russia at the time). In the second revolution, in October, the Provisional Government was removed and replaced with a Bolshevik (Communist) government.

4 'Manifest Letuchei Federacii Futuristov' (The Manifesto of the Flying Federation of Futurists). *Gazeta Futuristov* No.1, 15 March 1918. Trans. AS.

5 Lunacharsky, A.V. 'Chem dolzhen bit visshiy institute iskusstv'. *Iskusstvo* No.3, October 1918, p.17.

6 Morozov, S.A. *Prokofiev*. Moscow, 1967, p.64. Trans. AS.





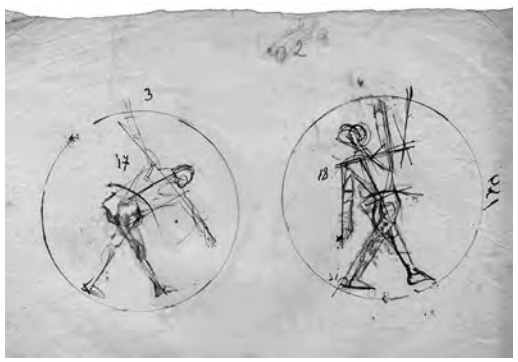


fig IV Solomon Nikritin. The draft manuscript of the Projectionists' Manifesto. 1924. RGALI.

fig V Solomon Nikritin. Draft manuscript. 1922. The manuscript illustrates an attempt to develop a typology and classification system for human movements according to the principles and terms of biomechanics and acoustics. RGALI.

fig VI Solomon Nikritin. Draft manuscript. 1922. Explanation of the biomechanical octave. RGALI.

of artistic approaches and movements were in the mix, including Futurism, Suprematism, Constructivism, Expressionism, Modernism and Realism. Many people aspired to acquiring 'universal knowledge' — an understanding of the laws of science that would help to explain the workings of the human body and mind, including concepts of aesthetics, creative accomplishment and cultural activity.

The ideas, projects and artworks created during this period are often considered utopian. However, there is no general definition or style that can lay claim to characterize the art of the late 1910s and 1920s. Nor does this time interval fit neatly into any system of representation about the unity of culture or its progressive development.

The economic conditions in Russia in the 1920s were austere. The Civil War had left three quarters of the territory of Russia in ruins, and millions of people had died of hunger. Technologically it was a backward country with a starving population, and while the government's aims may have been utopian, the situation was not, by any stretch of the imagination, reminiscent of the Golden Age of Greece or the Italian Renaissance.

A term that sought to capture the essence of the period was proposed by the artist and philosopher Solomon Nikritin (1898–1965).■ Projectionism (from the latin *projectus*, thrown forward) was intended to reflect the urge to *rush ahead*, or more accurately, to *rush into the future*. He applied this term not only to new approaches in painting and methods of art criticism, but also to the methodology of constructing a new society, to which it was considered necessary to aspire. In 1919 Nikritin developed his fundamental theory of Projectionism. According to his philosophy, the rational essence of nature is the highest goal of technology and culture. In his manifesto■ he asserted: 'the Artist is not a producer of consumer goods (a cupboard, a picture), but of (PROJECTIONS) METHOD — the organization of matter.'[7]

fig II

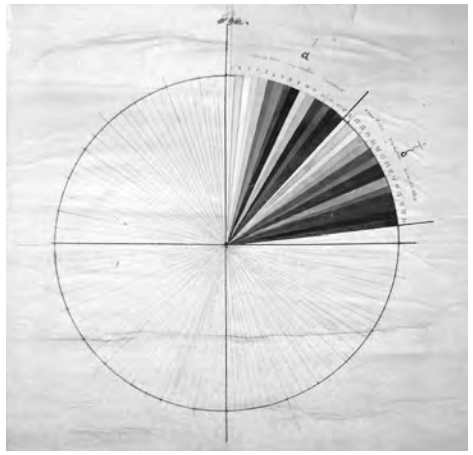
figs III—VII

Following this manifesto, Nikritin began to develop a universal language of the arts and presented, at the First Discussional Exhibition of Active Revolutionary Art (1924) his 'tectonic research' — texts, photographs, sketches, reliefs and a three-dimensional construction. A sign accompanying the display explained that the project required two hours of study, and the artist provided a stepladder for the use of exhibition visitors. To dispel any doubts about his technical expertise, he also exhibited a naturalistic portrait, accompanied by the written explanation: 'I am exhibiting this as a demonstration of my professional skill. I reject it because I consider it socially reactionary.'[8] His friends Luchishkin, Plaksin and Tyshler also exhibited drawings, photographs, volumetric models and hand-written theoretical calculations of research into pictorial space, instead of seeking to make end products of the creative process. The group was named 'the Method'.

The method, therefore, invented by the artist, becomes the purpose of the creative process. The intention was for new ideas to transfer creative energy into further development. For Nikritin and his collaborators, the real artist creates projects or 'projections' — i.e. ideas and concepts concerning

7 The catalogue of the First Discussional Exhibition of the Active Revolutionary Art, Moscow, 1924, p.9. Trans. AS.

8 *Ibid.*



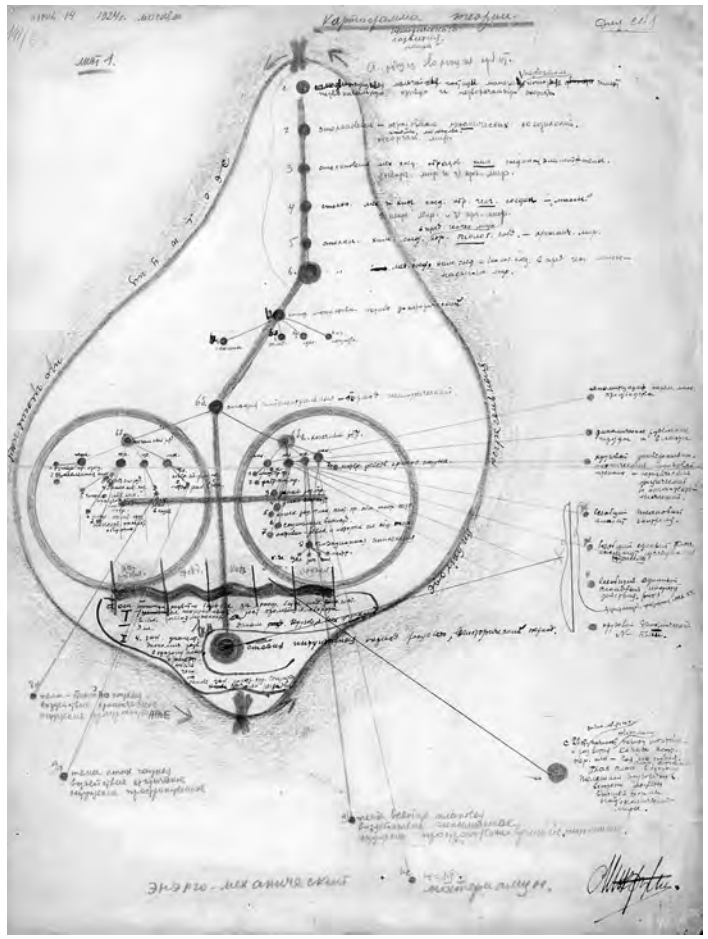


fig VII Solomon Nikritin. The system of organization of colour-sound sensations; tonal and noise definitions. Early 1920s. This diagram represents an attempt to create a classification and typology of the colour palette, based on the principles and terms of musical acoustics. Pchelkina, L. 'Eksperimentalnoye iskusstvo 1920-h v Rossii: teorija i praktika hudozhnikov proekcionistov (gruppa "Metod")'. In the collection *Eksperimentalnoye iskusstvo. Vlijanie teorii na hodozhestvennoje tvorchestvo*, Moscow, 2011. p.102.

fig VIII Solomon Nikritin. Cartogram of the Theory of Projectionism. 1924. Pchelkina, L. 'The Biomechanics of Voice and Movement in Solomon Nikritin's Projection Theatre (1920s)'. In the collection *Electrified Voices*, Dmitri Zakharine and Nils Meise (Eds.), Universität Konstanz, Germany, 2011 / V&R unipress, 2012.

subjects and phenomena. According to Nikritin, these projections of the method of the artist, solely reliant on the organization and presentation of the material, are the main substance of the work of art. 'All the intellectual work of the masses concentrated in one discipline — in the projectionist expression of organizational classification and methodology — is the realization of Projectionism. The contemporary art of Projectionism is tectonics — (the algebra of organizational science)...' [9]

In fact Nikritin's ideas are reminiscent of Alexander Bogdanov's project of *Tectology*.[10] What they shared was a desire to develop a universal science of organization and analysis through a search for structural similarities in all spheres of knowledge. Bogdanov advocated the re-examination of works of art to reveal their structure and underlying premises, as a step towards the development of a new art.

Reflecting on traditional art forms, Nikritin asserted:

...sculpture, architecture, music and poetry as art forms are already senseless... because, according to their material, [they] can't include the postulated image of today and consequently can't be an art any more. [11]

Rejecting traditional arts, Nikritin proclaimed the universal principles, common for all future arts, as being related to subjects such as sound, image, biomechanics and social engineering. The new language of art, for him, was based on terms such as *stream*, *dynamics* and *density*.

Nikritin tried to develop a typology and classification system of human movements and gestures, colour palettes, sounds (mainly related to the human voice) as well as emotional states, based on the principles and terms of biomechanics, musical harmony and acoustics. He developed, for example, biomechanical temperaments and scales for body movements.■ fig V
As a basis for the metrics Nikritin introduced the notion of the *octave*. In this case it defines the maximum area mechanically reachable by a dancer with their feet in a fixed position.■ figs VI, 4.9 Nikritin also introduced a number of neologisms, combining the languages of acoustics and biomechanics. In 1924 he went so far as to attempt to chart the process of the evolution of consciousness and the creative energy of society from simple, primitive states to the perfection of a future classless society. Based on a creative human network, this projected society would function without any central authority. Anticipating certain aspects of cybernetics, he called these diagrams 'the cartogram of the program'■ fig VIII — synonymous with the term 'algorithm'. According to the diagram, the evolution of the system is by society passing through the dots, called 'stages' — analogous to steady states or attractors of some kind in a dynamical system. The evolution is based on principles of Projectionism, carried out by means of cultural and artistic influences and includes a typology of human consciousness and creative energy.

9 Nikritin, S. 'Osnovnoe' (The Basics). Draft manuscript, 1924. RGALI, f.2717. op.1, e.h. 17, s.24. Trans. AS.

10 Alexander Bogdanov (1873-1928) was a politician and scholar, and founder of PROLETKULT; in 1926 he became the founding director of the first ever Institute of Blood Transfusion; he died in 1928, undertaking experiments with his own body.

11 Nikritin, S. Draft manuscript, 1920. Private collection of Hanna Raikhenshtein. Trans. AS.

The practical implementation of the theory was realized at the Projection Theatre, established by Solomon Nikritin and Sergey Luchishkin on 10 January 1922 within VKHUTEMAS[12] and after October 1923, functioned in close collaboration with Alexei Gastev's Central Institute of Labour. To generate the most complicated scores of sounds, gestures, movements and emotional states, actors were involved in a daily routine of exercises and psychological training. Specially made diagrams specified the distribution of various emotions in time such as anger, melancholy and sadness by representing them as percentages on a graph.

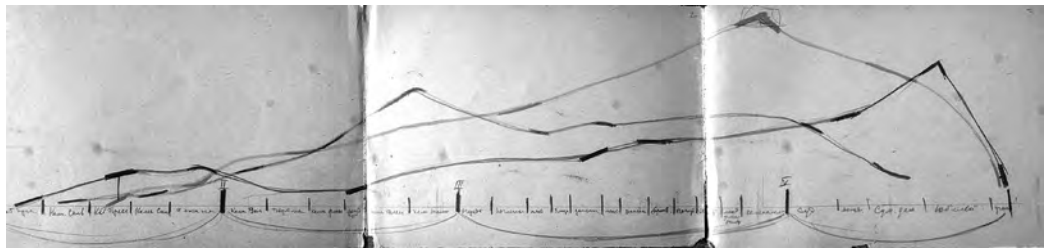


fig IX Sergey Luchishkin. Diagram of excitement (emotional states) of three actors during a study on excitement at the Projection Theatre. Mid 1920s. Pchelkina, L. 'The Biomechanics of Voice and Movement in Solomon Nikritin's Projection Theatre (1920s)'. In the collection *Electrified Voices*, Dmitri Zakharine and Nils Meise (Eds.), Universität Konstanz, Germany, 2011 / V&R unipress, 2012, p.154.

The purpose of the Projection Theatre was to teach the whole of society to master the human mind and body. Besides gymnastic apparatus and a 'noise orchestra', the Projection Theatre made use of mobile scenery and moving constructions designed by Nikolay Triaskin. Special projectors were included in the script of the theatrical production *Pressing and Impact* in 1923 as well as large screens behind the stage to produce a dynamical film projection as a part of the performance. Virtual characters from the film projection appeared to interact with the actors on the stage.[13] Many instances of the use of current multimedia technologies were already being explored in the performances of the Projection Theatre in the 1920s.

In the context of 'projecting the method' even faults and paradoxes gained a new constructive sense and value. In the early 1920s much project-based research took place that could be considered within the framework of Projectionism, including Alexei Gastev's Art of Movement exhibitions, the concert-lectures by Leon Theremin, and Arseny Avraamov's concert series Music of the Future, in which the author demonstrated his practical ideas regarding the future of musical harmony and techniques, rather than presenting finished musical pieces.

The atmosphere in 1920s Russia was like that of a creative laboratory. People were working towards realizing the projection of a bright future; everybody was inventing something, researching, and experimenting with the hope of finding a 'miracle' — the next big idea to catch on. These new trends strongly affected the Russian political and social spheres, and also played a role in the communal transformation of public consciousness.

12 VKHUTEMAS — *Vysshiye Khudozhestvenno-Tekhnicheskiye Masterskiye* (Higher Art and Technical Studios) — was the Russian state art and technical school founded in 1920 in Moscow.

13 The script of the show *Nazhim I udar* (Pressing and Impact), circa 1923. RGALI, f.2717, op.1, khr.12.

Special institutions were founded for the development and improvement of 'the New Human', engaged in the mastering and perfection of professional motion in sports, in working life, military activity, musical performance and so on. According to Leon Trotsky — 'the person will start to harmonise himself [...] trying to master his semiconscious, and then — unconscious processes in his own organism: breath, blood circulation, digestion, [he will want] to lift himself onto a new stage — to create, if necessary, a higher social-biological type — a superhuman.'[14] While some ideas were little more than science fiction at the time, many projects and proposals were more immediately viable or were actively seeking to develop the technology necessary to deliver them.

Industrialization, adopted in 1928 as the main economic project of the country, resulted in a desire to represent industry in sounds and artistic forms, often with a view to capturing the scale associated with industrial production. In Proletkult — the national agency established in 1917 for promoting proletarian culture — projects were encouraged such as the 'music of metal and machine tools' with huge sledge hammers and steel sheets used as musical instruments, simulating the heavy step of the victorious proletariat and the destruction of the former world. The score of Arseny Avraamov's *Symphony of Sirens* included parts for factory sirens, the horns of steam locomotives and even artillery fire. Alexander Mosolov worked on a ballet entitled *Steel*, which remained unfinished. Only a fragment of the work is known to exist, called 'Factory'. Leonid Polovinkin wrote *Electrificat and Telescope (I–IV)*. Vladimir Deshevov created the opera *Ice and Steel* as well as the piano piece *Rails*. Even such coryphaei as Sergei Prokofiev (creator of the ballet *Steel Step*) and Dmitry Shostakovich (creator of the ballet *Bolt*) included parts in their scores for heavy industry (locomotive hooters, the snapping of driving belts, etc.). Nowadays this music is seldom performed and in some cases has been almost completely overlooked.

While the history of Russian post-revolutionary avant-garde art and music is fairly well documented, the inventions and discoveries, names and destinies of the community of researchers of sound, creators of musical machines and noise orchestras, and founders of new musical technologies have been largely forgotten. This book offers an introduction to some of the key figures of the period and their areas of research, attempting to reconstruct an understanding of the Russian artistic utopia of the 1920s — a network of revolutionaries in art who realized seemingly unrealizable projects in sound, invented new musical machines, and who explored concepts and methods that offered a promising basis for future scientific and cultural development.

The fate of this community and the work it produced is a most unfortunate one. Its inherent incompatibility with the State's mandate for culture to promote totalitarian ideas soon predetermined its destiny. The struggle against experimental art, which was later pejoratively branded as 'formalism', was based on Lenin's thesis that 'Art belongs to the people' — namely that art should be clearly understandable for the

14 Trotsky, L. *Literatura i revolutsia* (Literature and revolution). Moscow, The publishing house of political literature, 1991, p.197.

masses and loved by them, while the language of the avant-garde is ostensibly complex and hence inaccessible to a wide audience.[15] This thesis was developed further in the resolution of the Russian Communist Party of Bolsheviks' Central Committee, dated 18 June 1925, 'On the Party's Policy in the Sphere of Fictional Literature', which initiated the State campaign against experimental art as well as many areas of experimentation and advancement in science and culture during the 1930s. While in the post-revolutionary period the relationship between State and pioneers had been a complicated one, the consolidation of Stalin's dictatorship as of the mid 1920s had resulted in a political sea change that gradually increased *vertical* authority pressure on the *horizontal* networks of society and culture, triggering a period of control, antagonism and repression among the most outstanding, skilled and innovative representatives of Russian society. By 1929 between 6,000 and 8,000 people had been imprisoned or exiled. The 'Philosophers' ship'[16] had already sailed to Europe and it was just a few years until the Great Terror.[17] By the late 1930s, the cultural and intellectual elite of the previous two decades had effectively been wiped out or rendered powerless.

Time has since confirmed the validity of much of their research and proven the foresight of many of their endeavours. The results of their work were often surprising and ahead of their time by decades. However, their collision with the totalitarian state was fatal. It was a period that in many respects was cut off in its prime — a period of technological and ideological advancement that has made a significant contribution to international science and culture and yet which, for primarily political reasons, ostensibly failed to achieve its potential or to gain the recognition it undoubtedly deserves. This publication hopes to help bring their achievements to light and ensure their contributions to art, technology and science are not forgotten.

Liubov Pchelkina

15 Zetkin, C. 'Vospominania o Lenine'. Moscow, Politizdat, 1976, p.15.

16 The collective name of several boats that carried Soviet expellees abroad. The main load was handled by two German boats, the Oberbürgermeister Haken and the Preussen, which transported more than 160 expelled Russian intellectuals in September and November 1922 from Petrograd to Stettin, Germany. Three detention lists included 228 people, 32 of them students. Other intellectuals were transported in 1923 by train to Riga, Latvia or by boat from Odessa to Constantinople.

17 The Great Terror (The Great Purge) was a series of campaigns of political repression and persecution in the Soviet Union orchestrated by Joseph Stalin, started in 1936. It involved a large-scale purge of the Communist Party and Government officials, repression of peasants, Red Army leadership, and the persecution of unaffiliated persons, characterized by widespread police surveillance and suspicion of 'saboteurs', imprisonment, and executions. Millions of innocent Soviet citizens were sent off to labour camps or killed in prison.

1. IN THE BEGINNING WAS THE WORD

AT THE CROSSROADS

One of the paradoxes within the early history of Russian sound art[1] is that only a few professional, academically educated composers were involved in it. To discover its roots researchers have to explore the activities of avant-garde artists, actors, painters, poets, scholars and inventors. They were people who would today be identified as cross-disciplinary or interdisciplinary artists, rather than composers or musicians. Anticipating future thinking in the musical fields of dynamism and the tactile qualities of sonorous masses, the artist Kazimir Malevich[2], who was invited in 1915 to teach the course on modern painting at the Moscow Studio-Theatre, wrote in his letter to the artist and composer Mikhail Matyushin:[3]

When I arrived there, I found the whole company of Bubnovy Valet[4] and [Nikolai] Roslavets,[5] which was acquainting listeners with Solfeggio. Yesterday there were committee elections and I was also invited and chosen as a committee member. All went perfectly until the discussion began about the definition of the main studio idea ... My position made it appear as though I was advising ravens in the field never to eat worms, but rather to eat grain. My statements about music as well as both decorative and theatrical art were met with bewilderment and impossibility as my art form expresses nothing.

The most confusion I caused, however, was when I told Roslavets that modern music should go in the direction of developing expressive musical layers and should possess the length and thickness of moving musical masses in time, and that the dynamism of musical masses should be replaced by staticism, i.e. holding back musical sonorous masses from temporal evolution. When I was asked which particular

1 A new aesthetical trend in the cross-point of music, acoustics and various experimental media.

2 Kazimir Malevich (1879-1935) was a Russian painter and art theoretician, born of ethnic Polish parents. He was a pioneer of geometric abstract art and the originator of the Avant-garde Suprematist movement.

3 Mikhail Matyushin (1861-1934) was a Russian painter and composer, and a leading member of the Russian avant-garde. He studied physiology of human senses and developed his own concept of the fourth dimension connecting visual and musical arts.

4 Bubnovy Valet (Jack of Diamonds) was a group of early Russian avant-garde artists founded in 1909 in Moscow. The group included Robert Falk, Aristarkh Lentulov, Ilya Mashkov, Alexander V. Kuprin, Alexander Osmerkin, Wladimir Burliuk and Pyotr Konchalovsky.

5 Nikolai Roslavets (1881-1944) was a significant Russian/Soviet modernist composer whose music was officially suppressed from 1930 onwards. In the 1910s Roslavets had been engaged in vigorous artistic debates provoked by Russian Futurism. Deeply influenced by the later works of Alexander Scriabin and his mystic chord, Roslavets' quest for a personal language began not later than in 1907; it led to his propounding a 'new system of sound organisation' based on 'synthetic chords' that contain both the horizontal and vertical sound-material for a work (a concept close to that of Schoenberg's twelve-tone serialism).

musical institution I completed my studies at, I simply immediately left my position as a committee-man and today I refuse to teach.[6]

Many cross-disciplinary artists from the 1910s were self-taught amateurs, combining knowledge in music, acoustics, literature, arts, psychology, physics, mathematics and other disciplines. The same was true worldwide. As the Hungarian painter and photographer, pioneering avant-garde polymath László Moholy-Nagy stated in an article of 1928-30: 'Contemporary "musicians" have so far not even attempted to develop the potential resources of the gramophone record, not to mention the wireless or ether-waves.'[7]

fig 1.1 The group of Petrograd futurists in the studio of Nikolai Kulbin. Front row, from the left: Nikolai Kulbin, Olga Rozanova, Arthur Lourie, Vladimir Kamensky. Back row, from the left: Ivan Puni, Vladimir Mayakovsky. *Sinij journal*, Petrograd, N.12, 1915, p.7. Museum for Modern Arts, Thessaloniki.

FREE MUSIC

Between 1908 and 1910, the avant-garde scene in St. Petersburg[8] was centred around the physician and painter Nikolai Kulbin (1868–1917), who maintained that all objects in the world were alive and that life itself was based on the universal principles of harmony and dissonance. Kulbin was one of the most influential Russian artists of the early 20th century.

6 Malevich, K. The letter to Mikhail Matyushin. 19 October 1915, Moscow. RO IRLI. F.656. Op. 3. N31. L. 30. Trans. AS.

7 Moholy-Nagy, L. 1928-30. 'Az új film problémái' (Problems of the Modern Film). *Korunk5*, No.10 (1930): 712-719

8 St. Petersburg is the second capital of Russia, and has been renamed several times. Prior to 1914: St. Petersburg; 1914-24: Petrograd; 1924-1991: Leningrad; and since 1991: St. Petersburg.

He took up art in 1908 at the age of forty. He is known now as a painter, graphic artist, theatrical designer and the theorist of Free Art and Free Music as well as one of founders of Russian Futurism. In 1908 he founded the Triangle 'psychological' artistic group and organised the Exhibition of Modern Trends in Art, which was the first ever show of avant-garde art in St. Petersburg. It was Kulbin who arranged the visits to Russia of Arnold Schoenberg in 1912 and the leader of Italian Futurism, Filippo Tommaso Marinetti, in 1914.

fig 1.2 Nikolai Kulbin. c. 1909. *Russkaya futuristicheskaya kniga*. Moscow, Kniga, 1989.

As a physician Kulbin graduated from the Military Academy of Medicine in St. Petersburg in 1892, working there as a lecturer from 1905 and as a surgeon at the Russian Army Headquarters between 1903 and 1917. In 1915 he reached the rank of full councillor of state. It was during this time that Kulbin declared the liberation of sound from its captivity by tradition. His theoretical treatise 'Free music. Musical applications of the new theory of artistic creativity' was based on his lectures conducted in 1908 and was printed in St. Petersburg in 1909. In 1912 it was published in Munich in the collection *Der Blaue Reiter Almanac* edited by Franz Marc and Wassily Kandinsky. Its significance for Russia was comparable with that of the *Sketch of a New Aesthetic of Music* published by Ferruccio Busoni in Europe in 1907. He asserted:

New possibilities are hidden in the sources of art itself, in nature. We are small organs of the living Earth, the cells of its body. Let's listen to its symphonies, which make up part of the common concert of the Universe. It is a music of nature, natural Free music... Everybody knows that the sounds of the sea and wind are musical, that thunder develops a wonderful symphony, and of the music of birds.[9]

9 Kulbin, N. 'Svobodnaya muzika' (The Free Music). St. Petersburg, 1909, pp.7-12. Trans. AS.

Anticipating the upcoming musical trends he wrote:

The music of nature is free in its choice of notes – light, thunder, the whistling of wind, the rippling of water, the singing of birds. The nightingale sings not only the notes of contemporary music, but the notes of all the music it likes. Free music follows the same laws of nature as does music and the whole art of nature. Like the nightingale, the artist of free music is not restricted by tones and halftones. He also uses quarter tones and eighth tones and music with a free choice of tones.[10]

Kulbin developed his art theory on the basis of his physiological and neurological studies. For him, the physical action of the universal movement of colour or sound served as outer stimuli that caused psychical effects in the spectator's brain. Kulbin declared harmony and dissonance to be basic principles of art.

A series of still unknown phenomena is revealed:

The close connection of tones and the processes of close connection.

These connections of adjunct tones of a scale, of quarter tones or even lesser intervals, may still be called close dissonances, but they possess special characteristics that customary dissonances do not.

These close connections of tones evoke unusual sensations in man.

The vibration of closely connected tones is extremely exciting.

In such processes the irregular beat and the interference of tones (which is similar to that of light) are of great significance.

The vibration of close connections, their unfolding, their manifold play, make the representation of light, colours, and everything living much more effective than customary music does.[11]

As an artist, philosopher and patron of the arts, Nikolai Kulbin was running a salon in St. Petersburg, a kind of informal association[12] that included most Russian avant-garde artists, composers, poets, scholars and so forth, which permitted him to spread his ideas among the artistic community. Although he died on 6 March 1917 just after the February Revolution, his influence on the young generation of revolutionary artists and scholars was significant. Among his direct or indirect followers were Arseny Avraamov, Leonid Sabaneev, Arthur Lourie and many others.

10 Kulbin, N. *Der Blaue Reiter Almanac* (The Blue Rider Almanac). Wassily Kandinsky, Franz Marc. Viking Press, 1974, pp.141-146.

11 *Ibid*.

12 In Russia this kind of establishment was called 'Kruzhok', which was a very popular form of informal association, most typical for artists, poets and musicians all around Russia.

THE LABORATORY OF HEARING

In 1916 a student at the Neurological Institute in Petrograd by the name of Denis Kaufman (a.k.a. Dziga Vertov), best known today as a revolutionary filmmaker, attempted what would now be called sound poetry and audio art. As he put it: 'I had an idea about the need to enlarge our ability for organized hearing. Not limiting this ability to the boundaries of usual music. I decided to include the entire audible world into the concept of "Hearing".'[13]

He attempted to create new forms of organization of sound by means of a rhythmic grouping of phonetic units. As a boy, Vertov wrote futuristic sound poems. In 1912, when he reached the age of sixteen, he entered the Białystok Conservatory[14] for three years to study violin, piano and music theory. According to Vertov, in Białystok he started his first experiments with the perception and arrangement of sound. During his schooling Vertov struggled with text. Once, preparing for classes, he discovered that after organizing geographical place names in a rhythmic order, he could easily remember the entire sequence. This became his favourite method of memorizing.

As a result of these self-enforced experiments I became interested in the rhythmic organization of separate elements of the visible and audible world in general. The next stage was my passion for editing shorthand records. It concerned not only the formal connection of these pieces but also the interaction of meanings of separate pieces of shorthand records. It also concerned my experiments with gramophone recordings, whereby from separate fragments of recordings on gramophone disks a new composition was created. But I was not satisfied experimenting with available pre-recorded sounds. In nature I heard considerably more different sounds, not just singing or a violin from the usual repertoire of gramophone disks.[15]

In 1914 his family fled from the invading German army to Russia, where in 1916 after a short period of military service Vertov entered the Neurological Institute in Petrograd – the only Russian institution prior to the February Revolution[16] that was accepting Jewish students. The same year during the summer vacation he began his first experiments with sound, which he called the Laboratory of Hearing.

On vacation, near Lake Ilmen.[17] *There was a lumber-mill which belonged to a landowner called Slavjaninov. At this lumber-mill I arranged a rendezvous with my girlfriend... I had to wait hours for her.*

13 Speech, 5 April 1935, Dziga Vertov. *Iz Nasledia* (From the Heritage), Vol.2. Eisenstein Centre, Moscow, 2008, p.291. Trans. AS.

14 Białystok is a Polish province, which at that time belonged to the Russian Empire.

15 Speech, 5 April 1935, Dziga Vertov. p. 291

16 The February Revolution of 1917 was the second revolution (after that of 1905) in the Russian Empire and the first of two in Russia in 1917. It led to the collapse of the tsarist regime and the inauguration of a democratic, republican government.

17 A resort area about 200km from Petrograd.

These hours were devoted to listening to the lumber-mill. I tried to describe the audio impression of the lumber-mill in the way a blind person would perceive it. In the beginning I wrote down words, but then I attempted to write down all of these noises with letters.[18]

Firstly, the weakness of this system was that the existing alphabet was not sufficient to be able to write down all of the sounds that you hear in a lumber-mill. Secondly, except for sounding vowels and consonants, different melodies, motifs, could still be heard. They needed to be written down as musical signs. But corresponding musical signs did not exist. I came to the conviction that by existing means I could only achieve onomatopoeia, but I couldn't really analyse the heard factory or a waterfall... The inconvenience was in the absence of a device by means of which I could record and analyse these sounds. Therefore I temporarily left aside these attempts and switched back to work on the organization of words.

Working on the organization of words, I managed to destroy that contrast which in our understanding and perception exists between prose and poetry... Some of these works, which seemed to me more or less accessible to a wide audience, I tried to read aloud. More complex works, which required a long and careful reading, I wrote down on big yellow posters. I hung out these posters in the city. I attached them myself.

My work and the room where I worked were called the 'Laboratory of Hearing'.[19]

Vertov moved to Moscow after the February Revolution of 1917. He entered the Department of Law at Moscow University and also attended lectures in the Department of Mathematics. But by the end of 1917 he had left the university. In May 1918 he was hired by the Moscow Film Committee as a secretary-clerk. Shortly after that he became manager of film production and then editor of the magazine *Kino-Nedelia* (Film-week). Being frustrated by the absence of any adequate means for sound recording he switched to film. As he reflected:

Once in the spring of 1918... returning from a train station there lingered in my ears the signs and rumble of the departing train ... someone swearing ... a kiss ... someone's exclamation ... laughter, a whistle, voices, the ringing of the station's bell, the puffing of the locomotive ... whispers, cries, farewells ... And I thought to myself whilst walking: I must get a piece of equipment that won't describe but will record, photograph these sounds. Otherwise it's impossible to organize, to edit them. They rush past, like time. The movie camera perhaps? Record the visible ... Organize not the audible, but the visible world. Perhaps that's the way out?[20]

18 Vertov uses the Russian word 'записывать', which means both to write down (primary meaning) and to record (sound), the meaning which came into being after the invention of sound recording. In several translations into English it was translated as 'record', which gives reason to assume that Vertov attempted to record sound on wax cylinders to produce sound collages. In fact Vertov never mentioned any technical means for sound recording available to him in 1916-18.

19 Speech, 5 April 1935, Dziga Vertov. p.291-292

20 Dziga Vertov. Draft copy of the article 'Kak eto nachalos?' (How has it begun?). Collection *Iz Nasledia* (From the Heritage), Vol.2. Eisenstein Centre, Moscow, 2008, p.557. Trans. AS.

fig 1.3 RADIO-EAR. Dziga Vertov. Portrait by P. Galadjev, 1926.
From the publication *Dziga Vertov. Iz Nasledia*, Vol.2. Eisenstein Centre, Moscow, 2008.

DZIGA VERTOV (1896–1954) was born Denis Abramovich (later changed to Arkadievich) Kaufman into a Jewish book-dealer's family in Białystok — a Polish province, which at that time belonged to the Russian Empire. His brothers, Mikhail Kaufman and Boris Kaufman, both became noted cinematographers. Vertov began writing poetry at the age of ten and at sixteen was attending the Białystok Music Conservatory where he studied violin and piano. He was never able to complete his studies as he was forced to flee to Russia with his parents due to the invasion by the German army. A resident of Russia as of 1915, Vertov studied neurology in Petrograd in 1917. While there, he began researching human perception with sound and created a Laboratory of Hearing. He took his pseudonym (loosely translated from Polish as 'spinning top' or literally 'top turning') at this time.

Following the Bolshevik Revolution in October 1917, Vertov was invited to become the writer, editor and overseer of a filmed periodical *Kino-Nedelia* (Cinema Weekly). Through this, Vertov began experimenting with creative editing. In 1919 he edited the full-length compilation film *Anniversary of the Revolution*. He followed it with two short films, *Battle of Tsaritsyn* (1920) and *The Agit-Train VTSIK* (1921). In 1922, he made the thirteen-reel *History of Civil War* (1922). Next Vertov started his own newsreel series, *Kino-Pravda* (Cine-Truth). During this period, Vertov developed his montage techniques and honed his growing theories about cinema as the art form best suited for the masses. In 1919 he joined with other filmmakers, including his future wife, Elisaveta Svilova, and his brother, Mikhail Kaufman, to form *Kino-Glaz* (Cinema-Eye). In 1922, the group published a revolutionary manifesto in which he derided all

fiction films as backward, packed with lies and powerless while lauding those films that recorded the truth of real life 'caught unawares'.

When sound technology came to film, Vertov was able to use it to full advantage in *Enthusiasm: Symphony of the Donbass* (1930), a film that utilized sound montages and earned him international acclaim, but was panned in the Soviet Union. Vertov next made *Tri Pesni o Lenine* (Three Songs About Lenin, 1934) and won a prize at that year's Venice Film Festival. It was not immediately released in Russia because it was felt that Stalin's role in the Revolution wasn't developed enough. His film *Kolybel'naya* (The Lullaby, 1937) was edited without Vertov's permission to make Stalin's role bigger. By then the conservative government had begun showing more interest in fictional features and Vertov ended up spending his last twenty years editing artless newsreels.

UPCOMING SCIENCE OF MUSIC

Meanwhile, in 1916, in the article 'Upcoming Science of Music and the New Era in the History of Music', composer, music journalist, theorist, and outspoken critic of the classical twelve-tone system Arseny Avraamov (1886–1944) predicted and explained different approaches to synthesizing sound. Dreaming of future possibilities of musical composition he wrote:

The timbre is the soul of a musical sound. To build abstract harmonic schemes and then 'orchestrate' them is not creative any more; in this way it is possible to reach a full decomposition of the process of musical creation down to the sequence of compositional exercises: to invent a sequence of tones, to incorporate any rhythm, to harmonize the melody obtained and, finally, to start its colouring, using an historically readymade palette... In the act of true creativity each sound should be born already incarnated...

And what if today it was already possible to transform the sustained chord of the flute timbre during ten seconds (absolutely imperceptibly for acoustical analysis) into the powerful tutti of brass winds, and then in three seconds to fade it imperceptibly into the quiet and clear timbre of the clarinet?...

And what about the wonderful timbres of vowels of human speech? Where are they in modern instrumental music? In Berlioz's Mourning March*? In Scriabin's* Prometheus*? Limited with a modest range of voices of the chorus? And what if I need a scale-like passage on a timbre, 'o-o-h' upwards, up to the highest audible pitches? And not for the sake of a whim, but according to a clear creative necessity?*[21]

Being a good self taught acoustician (in his youth he took great interest in reading works by Helmholtz[22]) Avraamov went much further — prior to the invention of the Theremin and thirty-five years before the creation of the first Electronic Music studio he suggested an approach to sampling, analysing, processing and resynthesizing sounds. Avraamov noted: 'By knowing the way to record the most complex sound textures by means of a phonograph, after analysis of the curve structure of the sound groove, directing the needle of the resonating membrane, one can create synthetically any, even the most fantastic sound by making a groove with a proper shape, structure and depth...'[23]

Six years later a similar idea was proposed by László Moholy-Nagy. In his essay 'Production-Reproduction' he suggested that 'one undertake a scientific examination of the tiny inscriptions in the grooves of the phonograph in order to learn exactly what graphic forms corresponded to which acoustic phenomena' and to start with 'laboratory experiments: precise examination of the kind of grooves (as regards length, width, depth, etc.) brought about by the different sounds; examination of the man-made grooves; and finally mechanical-technical experiments for perfecting the groove-manuscript score.'[24] Avraamov went much further: he proposed a method of sound synthesis based on mathematical modelling of acoustical properties of sounding objects that is quite similar to today's techniques of physical modelling.

Much more complex are the relations between music and mathematics when we move to the realm of timbre or sound colour. Here we have to take into account not only the arithmetical order of overtones, conditioning each particular timbre, but also the way of physical motion of the vibrating string, reed, air column. To express those values higher mathematics is required already. For example, here is the formula that expresses the motion of a violin string under the action of the bow:

$$y = \frac{8P}{\pi^2} \sum_{n=1}^{n=\infty} \left\{ \frac{1}{u^2} \sin \frac{n\pi x}{L} \sin \frac{2\pi n}{T}\left(t - \frac{A}{2}\right) \right\}$$

Where P is an amplitude of fluctuations of the string in the middle, L is its length; T, t and A: periods of fluctuations of different points of the string; n: the number of oscillations of the lens of the vibrating microscope, used to observe the movement and so on.[25] *Even more complex are the formulae of vibrations related to the basilar membrane of the cochlea of the organ of hearing as it perceives sound. All that has already been investigated, estimated and – alas! – lies shelved for decades without the slightest influence on art progress.*[26]

21 Avraamov, A. 'Upcoming Science of Music and the New Era in the History of Music'. *Musical Contemporary Magazine,* 1916, No.6. p.84-86. Trans. AS.

22 Curriculum Vitae of Avraamov-Krasnokutsky. RGALI, fund 984, op.1, ed.hr. 46, pp.2-3. Quoted in *Kinovedcheskie Zapiski*, 2001, No.53, p.297.

23 Avraamov, A. 'Upcoming Science of Music and the New Era in the History of Music'. *Musical Contemporary Magazine*, 1916, No.6, p.85. Trans. AS.

24 Moholy-Nagy, L. 'Production-Reproduction'. First published in *De Stijl 5*, 1922, No.7, pp97-101.

25 This formula is quite mysterious. In the original text not all the variables are explained. The role of the bow in supplying energy to the process is not clear, for example. It should be considered as part of a rough proposal rather than a well-defined solution, but the concept nonetheless remains ahead of its time.

26 Avraamov, A. 'Upcoming Science of Music and the New Era in the History of Music'. *Musical Contemporary Magazine*, 1916, No.6, p.89. Trans. AS.

Arguing in favour of the new forty-eight-tone microtonal ultra-chromatic scale named the 'Welttonsystem', Avraamov intended to achieve the possibility of combining the well-tempered scale with the natural one based on series of overtones. Of all the early pioneers of microtonal ultra-chromatic music Avraamov alone pursued the approach of erasing the difference between the pitch-based harmony structures and the spectral tissue of sound. He envisioned future ultra-chromatic musical instruments not so much as a way to reach a new microtonal harmony but as a way to realize new exciting possibilities of additive synthesis.

fig 1.4 Arseny Avraamov. c. 1920. Courtesy of Oleg Komissarov.

ARSENY AVRAAMOV (1886-1944), aka Revarsavr (Revolutionary Arseny Avraamov), Ars, Arslan-Ibrahim-ogli-Adamov among other monikers, was one of the most adventurous people of his time. His biography is somewhat enigmatic — even his own accounts vary depending on for what and for whom they were written. According to some of his own accounts his original name was Krasnokutsky, although he denied it elsewhere in his notes. In spite of the fact that most of Arseny Avraamov's archives did not survive, his heritage and importance are invaluable. Composer, acoustician and musicologist, music journalist, expert in Caucusian folk music, inventor, performance instigator, creator of the first ever artificial soundtrack — the range of Avraamov's professional skills was enormous.

From 1908-11 Avraamov studied the theory of music with professors Ilya Protopopov and Arseny Koreshchenko in musical classes of the Moscow Philharmonic Society. He also took private lessons in composition with composer Sergei Taneyev. As of 1910 he was involved in various publications as a musical critic under the pseudonym of Ars. In 1912 whilst in the Cossack military division he was arrested and imprisoned for propaganda. After escaping from prison he moved to Norway where he worked as a sailor on the cargo ship Malm Land. In 1913 he joined a travelling circus as a dzhigit-equestrian, acrobat and musician-clown. The same year he moved to St. Petersburg. To simplify Avraamov's 'social adaptation' composer Nikolai Roslavets wrote a letter of support for him, addressed to Nikolai Kulbin, in which he asked Kulbin to take care of his friend Arseny Avraamov 'the skilled musician and the most talented journalist writing mainly concerning art'. Roslavets wrote further: 'It is that Avraamov about whom I spoke with you when I stayed in St. Petersburg — the propagandist of the natural (overtone-based) scale in music and the inventor of corresponding musical tools.' [27]

From 1914-16 in Petrograd Avraamov was a member of the editorial boards of the magazines *Muzikalni Sovremennik* (Musical Contemporary Magazine) and *Letopis* (the Chronicle). In parallel in Moscow he was an employee of *Muzika* magazine. As early as 1916, in the article 'Upcoming Science of Music and the New Era in the History of Music',[28] Avraamov predicted and explained different approaches to synthesizing sound, including some of today's latest techniques of physical modelling.

From 1916-17 he taught the course of Musical Acoustics at the Pressman Conservatory in Rostov-na-Donu city. Just after the October Revolution in 1917-18 he was the Governmental Commissar of Arts at Narkompros and head of the Musical Department of Proletkult in Petrograd. In 1918-19 he was the Head of the Art Department at Narobraz (Committee for Education) in Kazan. During the Civil War he worked as a cultural curator at the Political Department of the Red Army as well as an editor of the newspaper *On the Guard of Revolution in Rostov-na-Donu*, teaching there at the Conservatory as Professor of Ethnology and working for Narobraz (Muzo)[29] until 1920. From 1922-23 in Baku he was a teacher at the Communist Party High School. He was also a cultural promoter at military courses for the Central Committee of AKSM [30] in the city of Armavir.

In a series of articles from 1914-16 he developed the theory of microtonal 'Ultrachromatic' music and invented special instruments to perform it. Shortly after the October Revolution he proposed to the Commissar of Public Enlightenment, Anatoly Lunacharsky, a project to burn all pianos — symbols of the despised twelve-tone, octave-based 'well-tempered' scale, which he believed had adversely affected human hearing for several hundred years. During the 1920s Avraamov experimented with 'prepared' pianos, harmoniums and various noise sources as well as a symphony orchestra to develop new approaches to organizing sound that are very similar to recent techniques of electroacoustic and spectral music. He explored new genres of music devised for urban contexts and presented them around the built environment, including the acclaimed *Symphony of Sirens*, first performed in Baku in 1922.

27 RNB (Russian National Library), dept of manuscripts, file 124, unit of storage N3.

28 Avraamov, A. 'Upcoming Science of Music and the New Era in the History of Music'. *Music Contemporary Magazine*. 1916, No.16.

29 'Muzo' is the musical sector of the National Department of Education (Narobraz).

30 The communistic union of youth of Azerbaijan.

In 1923 Avraamov returned to Moscow. Homeless and having no means of subsistence, he spent his nights in the legendary Pegasus Stall — a cafe run by a group of Futurists: 'The only advance payment I received from publishers I have spent on an overcoat etc. It was necessary. I eat at the Pegasus Stall — the cafe of the Imaginists — gratis, on account of future blessings, lodging for the night in a separate cabinet — in a word, I am sharing the stable with Pegasus.' [31]

From 1923-26 in Moscow he worked at GIMN (The State Institute for Musical Science) and in 1926-31 in Leningrad he worked at the State Institute for History of Arts. In summer 1927 Avraamov was officially sent to the International Exhibition being held in Frankfurt am Main, Germany.

From 1929–30 he worked at the first Sovkino factory as a composer of the first sound-on-film movie *Piatiletka: The Plan of the Great Works* as well as at the third Souzkino factory [32] as a musical adviser for the film *Olympiad of the Arts*. It was Avraamov who in 1930 completed the first artificial Graphical soundtrack based on geometric profiles and decorative ornaments — produced purely through drawing methods. In 1930 in Moscow at the Mosfilm Production Company, in order to develop research into artificial Ornamental Sound, Avraamov founded the Multzvuk group, which moved several times and was hosted by different organizations before finally closing in 1934. Avraamov then moved to Kabardino-Balkaria — the Soviet Republic in the Caucasus Mountains. As an expert in folk music specializing in the Caucasus region, he saw it as his mission to revive the musical culture in this small mountain country.

In 1938, after four years of isolation in Caucasus, Avraamov returned to Moscow in the middle of Stalin's Great Terror. In some fatal synchronicity with Leon Theremin and many other outstanding scholars and artists, he found himself in a cultural desert, filled with fear, ignorance and indifference. Shortly after his return many of his former colleagues from Kabardino-Balkaria were arrested. His documents, which he had left there, disappeared together with other archives, confiscated by NKVD.[33]

In July 1940 one of the leading Russian composers, former futurist Mikhail Gnesin, wrote a letter of support for Avraamov. As he asserted: 'Arseny Mikhailovich Avraamov is one of the most outstanding figures in Soviet musical art I have ever met in my life… A. Avraamov should also be recognized as a founder of Soviet musical acoustics. The majority of Soviet scholars in the field of acoustics (even having different convictions) are his pupils, or have begun their work under his influence.' [34] It was in vain, however, as for the Soviet State of the late 1930s his merits and past achievements were no longer important. At this point he was practically lost and destitute, living with his wife and ten small children in a single room of his Moscow flat, trying to survive without a regular job, and having only a small pension. Arseny Avraamov died on 19 May 1944.

31 Rumiantsev, S. *Ars Novi*, Moscow, Deka-BC, Moscow, 2007, p.108. Trans. AS.

32 The former name of the film production company 'Lenfilm' in Leningrad was 'Sovkino' in 1926-30 and 'Souzkino' in 1930-32.

33 NKVD — Russian abbreviation of the People's Commissariat of Internal Affairs. NKVD was renamed several times: MGB, KGB, FSK, FSB — these were all names of the Russian secret services at different times.

34 Gnesin, M. Recommendation letter of 10.07.1940. Courtesy of Oleg Komissarov (Avraamov's grandson). Trans. AS.

THE ENEMY OF MUSIC

In the summer of 1917 in Petrograd, inspired by the ideas of Arseny Avraamov, the young inventor Evgeny Sholpo (1891-1951) wrote a science-fiction essay entitled 'The Enemy of Music' in which he described a sound machine named the Mechanical Orchestra, capable of synthesizing any sound and producing music according to a special graphical score without any need for a performer.■ The essay was accepted for print in 1918 by the magazine *Melos*, edited by one of the most authoritative Russian musicologists of the time, Igor Glebov (aka Boris Asafiev). Unfortunately the third issue, in which it should have appeared, was never released as the magazine was closed down. fig 1.5

The same fate awaited 'The Enemy of Music' with the magazine *Musical Chronicle*, which was in print in 1924 and edited by A. N. Rimsky-Korsakov. The magazine was closed prior to publishing the essay.[35]

In his essay Sholpo describes the activities of an imagined friend — a sort of polymath, combining the skills of a musician, composer and analyst on the one hand, and a scientist, technologist, mathematician and psycho-physiologist on the other. Having fundamental disagreements and clashes with 'patented' musicians, the imaginary friend had been expelled from their circles and branded an 'Enemy of Music', and so he pursues his path alone in search of the 'true' possibilities of music.

The introductory chapter is almost entirely dedicated to the declarative letter of 'my friend' to the author, in which he considers the musical performer as a superfluous and often harmful intermediary between the composer and the listener. Sholpo's imaginary friend explains: 'Owing to the absence of other music, I work on the analysis of my own pieces, created in such a handicraft way... I discovered very interesting relationships and as I entered the domain of musical form, these dependences became more and more complex and imperceptible, but nevertheless, better defined; the borders within which data was grouped became increasingly narrowed...' [36]

THE MECHANICAL ORCHESTRA

The second chapter of Evgeny Sholpo's story describes the Mechanical Orchestra and the process of its demonstration. According to his description the instrument was an exact prototype of the famous ANS Synthesizer, built forty years later in Moscow by Evgeny Murzin. The instrument incorporated a set of sine wave oscillators, based on

35 Sholpo, E. 'The Artificial phonogram on film as a technical means of music', Collection of works of the Research Institute for Theatre and Music, Leningrad, 1939. p.249. Trans. AS.

36 *Ibid.*

numerous Helmholtz tuning forks, adjusted on fixed frequencies, forming a discrete microtonal scale, covering the whole audible range with intervals between successive pitches unperceivable to the human ear.

Control over the system and the process of sound synthesis was to be carried out by means of a special graphical score with the diagram, representing the spectrum of a sound by means of cut-out transparent strips, having appropriate shape and slopes, read by a special optical system. This optical system was based on selenium photo cells, which allowed a complete set of sine wave tones to be operated synchronously and independently, controlling the sound on a spectral level, directly manipulating the partials, and erasing the difference between the pitch-based harmony structures and the spectral tissue of a sound.

In those days radio engineering and the photo cell were poorly known and untested means in the area of acoustics, so my imagination didn't go further than Helmholtz's electromagnetic tuning forks with which he could synthesize timbres, certainly as regards the development and complexity of the 'mechanical orchestra'...

The bulky construction occupies half a room, with black paper tape stretching from one wall to another with a diagram of music made up of cut-out longitudinal holes similar to those of a pianola, a network of electric cables and a set of megaphones – all of which can be justified technically, but its basic principles were simply too complicated. Each electromagnetic tuning fork equipped with a resonator had a constant pitch and could be switched on irrespective of the others. Thus, a number of audio-frequency generators made rather fractionally tempered scales in a range from low basses up to the highest overtones...

Owing to the divisibility of a pitch scale, glissando appears to be almost ideally smooth, having no audible intervals between successive tones... The intensity of separate sounds, both in a melody and in chords, was set by adjusting a width of cuts of the diagram through which light beams, produced by a special light source, could reach the selenium elements of the conductors that lead an electric current to the magnets of the generator-tuning forks. Here selenium is used as a photo cell, but its function is limited to controlling the intensity of sound. [37]

As an acoustician, Sholpo had a good understanding of the spectral nature of sound. His view on imagined music, composed and synthesized by the *Mechanical Orchestra*, was very close to recent approaches in electroacoustic music. According to his description of the construction of the machine and the music created with it, it was a powerful spectro-morphological tool.[38]

37 Sholpo, E. 'The Artificial phonogram on film as a technical means of music', Collection of works of the Research Institute for Theatre and Music, Leningrad, 1939. p.250. Trans. AS.

38 Spectromorphology is an approach to sound materials and musical structures which concentrates on the spectrum of available pitches and their shaping in time. A descriptive spectromorphological analysis of sound is sometimes used in the analysis of electroacoustic music. The term was coined by Denis Smalley in 1986.

I could not realize a structure for this music; I only vaguely understood that the reason for its imperious influence lies not only in the composition but also in the material itself, from which it is created...

There were no sharp borders between a melody, harmony and orchestration: melodies comprise the harmonious element quite obviously expressed in changes of a timbre; the richness of harmonies gives orchestral colour, with prevalence of this or that shade. Thus any possibility of theoretical analysis is suppressed: in the multitude of sounds it has been impossible to separate a melody from a harmony and harmony from orchestration; one could not find initial points for the coordination of sound elements...[39]

In fact Sholpo offered not simply a new technique, but a new concept for the reconstruction of the technical basis of music, capable of bringing about a paradigm shift in musical thinking, and demanding new theoretical substantiation. Sholpo writes: 'Arbitrary access to timbres brings forth a whole arsenal of new laws, previously unavailable to us... I have begun my research with the elementary things – rhythm, melody and harmony (i.e. the new harmony, based on overtone combinations).'[40]

Describing music, Sholpo doesn't talk about notes as separate events – following Avraamov, he thinks in categories of continuity, sonority, spectrum and its temporal dynamics.

I felt the approach of the ending...

The prompt crescendo suddenly grew to a passionate shining fortissimo and was resolved in a dazzling impact of bells. It was as if ringing lightning had pierced the sky. I noticed how fast, one behind another, all the overtones thawed, blurring in a dim-matte timbre. But suddenly, with a new force, overtones entered and the timbre again obtained a brilliant bell-like sonority. It was a well-known timbre glissando, about which we dreamed as the top achievement of musical techniques...

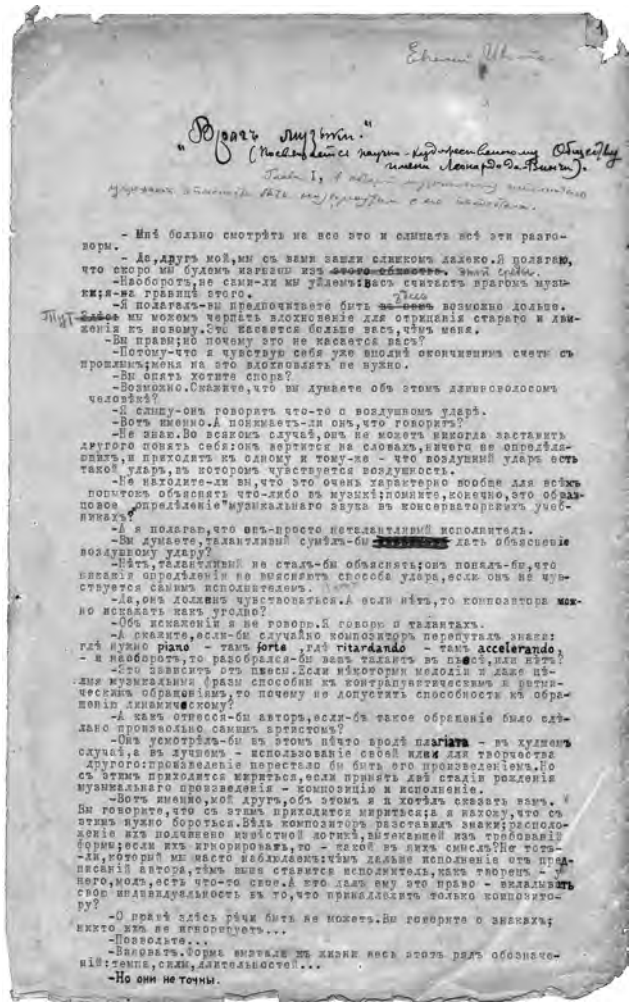
Its effect was amazing...

The adagio of the ending had begun...[41]

39 Sholpo, E. 'The Enemy of Music'. Manuscript, 1917-18, p. 11. Marina Sholpo's personal archive. Trans. AS.

40 *Ibid.*

41 *Ibid.* p.12.



"Взоръ Музыки."
(Посвящается науч.-художественному Обществу имени Леонардо да Винчи).

Глава I, в которой музыкальное воспитание...

- Мнѣ больно смотрѣть на все это и слышать всѣ эти разговоры.

- Да,другъ мой,мы съ вами зашли слишкомъ далеко.Я полагаю, что скоро мы будемъ нарезаны изъ этого общества.

-Наоборотъ,не сами-ли мы удалемъ:васъ считаютъ врагомъ музыки;я-на границѣ этого.

-Я полагаю-вы предпочитаете быть здѣсь возможно дольше.

Тутъ здѣсь мы можемъ черпать вдохновеніе для отрицанія стараго и движенія къ новому.Это касается больше васъ,чѣмъ меня.

-Вы правы;но почему это не касается васъ?

-Потому-что я чувствую себя уже вполнѣ окончившимъ счетъ съ прошлымъ;меня на это вдохновлять не нужно.

-Вы опять хотите спора?

-Возможно.Скажите,что вы думаете объ этомъ длинноволосомъ человѣкѣ?

-Я слышу-онъ говоритъ что-то о воздушномъ ударѣ.

-Вотъ именно.А понимаетъ-ли онъ,что говоритъ?

-Не знаю.Во всякомъ случаѣ,онъ не можетъ никогда заставить другого понять себя:онъ вертится на словахъ,ничего не опредѣляетъ,и приходитъ къ одному и тому-же - что воздушный ударъ есть такой ударъ,къ которому чувствуется воздушность.

-Не находите-ли вы,что это очень характерно вообще для всѣхъ попытокъ объяснять что-либо въ музыкѣ:помните,конечно,это образцовое опредѣленіе"музыкальнаго звука въ консерваторскихъ учебникахъ?

-А я полагаю,что онъ-просто неталантливый исполнитель.

-Вы думаете,талантливый сумѣлъ-бы дать объясненіе воздушному удару?

-Нѣтъ,талантливый не сталъ-бы объяснять;онъ понялъ-бы,что внѣшнія опредѣленія не выясняютъ способа удара,если онъ не чувствуется самимъ исполнителемъ.

-Да,онъ долженъ чувствоваться.А если нѣтъ,то композиторъ можно искалѣчить какъ угодно?

-Объ искаженіи я не говорю.Я говорю о талантахъ.

-А скажите,если-бы случайно композиторъ перепуталъ знаки: гдѣ нужно piano - тамъ forte ,гдѣ ritardando - тамъ accelerando, - и наоборотъ,то разобрался-бы вамъ талантъ въ пьесѣ,или нѣтъ?

-Это зависитъ отъ пьесы.Если нѣкоторыя мелодіи и даже цѣлыя музыкальныя фразы способны къ контрапунктическимъ и ритмическимъ обращеніямъ,то почему не допустить способность къ обращенію динамическому?

-А какъ отнесся-бы авторъ,если-бъ такое обращеніе было сдѣлано произвольно самимъ артистомъ?

-Онъ усмотрѣлъ-бы въ этомъ нѣчто вродѣ plagiata - въ худшемъ случаѣ,а въ лучшемъ - использованіе своей идеи для творчества другого;произведеніе перестало-бы быть его произведеніемъ.Но съ этимъ приходится мириться,если принять двѣ стадіи рожденія музыкальнаго произведенія - композицію и исполненіе.

-Вотъ именно,мой другъ,объ этомъ я и хотѣлъ сказать вамъ. Вы говорите,что съ этимъ приходится мириться;я нахожу,что съ этимъ нужно бороться.Вѣдь композиторъ разставилъ знаки;расположеніе ихъ подчинено извѣстной логикѣ,вытекающей изъ требованій формы;если ихъ игнорировать,то - какой въ нихъ смыслъ?Не тотъ-ли,который мы часто наблюдаемъ:чѣмъ дальше исполненіе отъ предписаній автора,тѣмъ выше ставится исполнитель,мнящій творецъ - у него,молъ,есть что-то свое.А кто далъ ему это право - вкладывать свою индивидуальность въ то,что принадлежитъ только композитору?

-О правѣ здѣсь рѣчи быть не можетъ.Вы говорите о знакахъ; никто ихъ не интерпретуетъ...

-Позвольте...

-Извините.Формы знаковъ въ жизни весь этотъ рядъ обозначеній:темпа,силы,длительностей...

-Но они не точны.

fig 1.5 First page of the manuscript of the essay by E.Sholpo 'The Enemy of Music' (Petrograd, 1917-18), in which he describes a musical machine, capable of automatically synthesizing complex sound spectra and their transformations, according to a special graphical score. Marina Sholpo private archive. Courtesy of Marina Sholpo.

fig 1.6 Evgeny Sholpo. c. 1920. Courtesy of Marina Sholpo.

fig 1.7 Rudolph König's Grand Tonometer. Based on multiple tuning forks and adjusted in microtonal scale, the Grand Tonometer is similar to the set of sine wave oscillators of the Mechanical Orchestra proposed by Evgeny Sholpo. c. 1890. Glass photo-plate from the GIMN (State Institute for Musical Science) library. TCA.

fig 1.8 Evgeny Sholpo. Late 1930s. Courtesy of Marina Sholpo.

EVGENY SHOLPO (1891-1951) was born on 23 April in Porhov town, Pskov region. In 1908 he finished College in Pskov and entered the Institute of Civil Engineers in St. Petersburg, but he did not complete his studies as he opted to pursue a career as a freelance musician. From 1918-22 he undertook military service for the Red Army during the Civil War in Russia, working as a draughtsman in the Bureau of Commissioners of Military-Engineering Management for the Petrograd District.

Overlapping with this, between 1920 and 1923 he was teaching geodesies, planning and creating art at Oranienbaum Wood Technical school. At the same time he was taking classes on musical theory with Professor V.P. Kalafati. From 1923-24 he worked as a draughtsman for the Electrik factory and for the Management of the State Electrotechnical Trust. During this time he wrote a research paper entitled 'Introduction to the experimental analysis of piano performance'. In 1925 he worked as an illustrator at the State publishing house. On 1 January 1926 he was hired by the State Institute for History of Arts as an assistant manager of the Laboratory for Musical Acoustics. When the Institute was reorganized as a Leningrad branch of the State Academy of Art History, he became an assistant at the Film-Laboratory. In 1930 he worked as a constructor in the Audio Sector of the Sovkino Film Studios. As of 1932 he was a manager of the department for Graphical Sound at the Scientific and Technical Laboratory of the Lenfilm Studios, before going on to work at the Souztechfilm Studios in 1934.

On 1 January 1936 Sholpo joined the Leningrad branch of ANTES (The Autonomous Scientific-Technical Sector at the Union of Composers) as a manager of the development of the Variophone. A year to the day later, he was appointed head of the Laboratory for Graphical Sound at the Scientific-Research Institute of Music (later renamed the Scientific Research Institute of Theatre and Music).

In 1940 Sholpo received a Doctoral Degree in Art Criticism. The previous year, Sholpo and Boris Yankovsky had decided to unite their efforts and to establish a new Laboratory for Graphical Sound in Leningrad. The project was interrupted by World War II when it crossed the border of the USSR in June 1941. Sholpo spent the first six months of the war in Leningrad working on the soundtrack for the cartoon *Sterviatniki*.■ In December 1941 he was evacuated to Tashkent with the equipment of the Leningrad Conservatory. He taught at the Conservatory there until 1944, when he returned to Leningrad.

fig 7.20-21

In 1946 Sholpo became a director of the new Scientific Research Laboratory for Graphical Sound at the State Institute for Theatre and Music in Leningrad. In 1947 a criminal case was brought against him — he was accused of wasting resources. The facts were not proved to be true and the case was dropped. Nevertheless, the laboratory was reorganized and moved to Moscow, and Sholpo was removed from his position as director. In 1950 the Laboratory was finally closed. Evgeny Sholpo died in 1951 after a long illness.

THE LEONARDO DA VINCI SOCIETY

Arseny Avraamov's article 'Upcoming Science of Music and the New Era in the History of Music', published in 1916,[42] called to unite the efforts of all of those who believed in the importance of scientific analysis to support the theory of music. A consequence of this publication was the establishment of a new association called the *Leonardo da Vinci Society*, which was founded in the spring of 1917 in Petrograd by Evgeny Sholpo and Arseny Avraamov accompanied by the young mathematician and musicologist Sergei Dianin. Belief in the power of science, and aspiration to objective knowledge of the 'mysterious' laws of art — these were the reasons for which the society appropriated this historical name. Their objective was to unite efforts to produce a revolution in music theory and techniques based on the cross-connection of the arts and sciences. They declared that academic views on music theory were dull and scholastic, and that techniques relating to it were old fashioned, proclaiming that both were becoming increasingly outdated. As Sholpo put it: 'Physicists are needed who would begin research into the laws of the generation and distribution of sounds: physiologists are necessary who would investigate the processes of perception of sounds by the ear and their influence in general on the human body; besides that, both (mainly physiologists and also psychologists) should be skilled in mathematics to make the results of their research understandable so that the data obtained can be considered as certain factors instead of shapeless, sketchy hypotheses.' [43]

There were many artists and young scholars involved in the activities of the Leonardo da Vinci Society, including, presumably, Leon Theremin during the 1920s.[44] Sergei Dianin was making a mathematical study of acoustics and music theory; Arseny Avraamov was applying physics and history in the fields of the philosophy and sociology of music; and Evgeny

42 Avraamov, A. 'Upcoming Science of Music and the New Era in the History of Music'. *Musical Contemporary Magazine*, 1916, No.16, p.82.

43 Sholpo, E. 'The Enemy of Music'. Unpublished manuscript, 1917-18, p.7. Marina Sholpo's personal archive. Trans. AS.

44 Leon Theremin's remark during the discussion after his report 'The coherence and the consonance of stationary and unsteady sonorities'. Shorthand from the seminar, Moscow, 1967. TCA.

Sholpo was focused on the development of a device for the automatic monitoring and registration of the temporal characteristics of piano performances. He was interested in the opportunity to gain exact objective data about the process of musical performance. As he noted:

We were sure that by knowing this data we could get an analytical insight into the secrets of creativity (at least in performance) and, armed with mathematical formulae, break mystical and idealistic tendencies with an explanation of the phenomena of music creation. Further, we would subordinate the performing stage of creativity to mathematical laws and, having constructed a precise and obedient operating mechanism with which to automatically carry out our tasks, we would create a masterpiece of musical performance that would eclipse all the stars of the musical scene. We conducted while undermining the musical performer.

This 'cast of intermediaries' between the ideas of the composer and the perception of the listener seemed to us superfluous; we despised the acrobatic exercises of the unfortunate pupils at the conservatory, putting all individuality into physical work through the nervous-muscular mechanism of their hands. We preferred them to be working with their heads. It was a protest against traditions and the habitual ideas that had been sustained by the bourgeois system; it was an aspiration to break the old and to build the new. We couldn't have imagined, though, that musical culture has in itself values which should be kept and from which in many respects we would need to proceed.[45]

In 1918-20 the members of the Society were separated by the Civil War. Having met after its termination, Sholpo, Dianin and Avraamov continued to work on common research. As Evgeny Sholpo recollected:

...having converged again, we found that Sergei Dianin had made a mathematical formula of the musical scale; Arseny Avraamov had developed a universal system of tones (the Welttonsystem), and I had constructed the Melograph *(a device for the automatic registration of piano performances). But practically, in the sense of new technology, we had not made anything. Arseny Avraamov was compelled to demonstrate his system of tones by means of four pianists playing four retuned grand pianos, spending energy to overcome a human stagnancy, organizing choruses and instrumental ensembles which would obey his creative idea. Sergei Dianin, searching for new timbres, was fighting with an iron string, forcing it to vibrate contrary to the laws of mechanics. And I assigned hopes for the Welte-Mignon (an automatic grand piano), considering it as the only machine capable of apprehending and transferring the will of the composer, but – alas! – constrained by piano timbres. It was infinitely far from the 'Mechanical Orchestra' and the 'synthesis of timbres'. Only the invention of sound cinema was able to change everything...*[46]

45 Sholpo, E. 'The Artificial phonogram on film as a technical means of music'. Collection of works of the Research Institute for Theatre and Music, Leningrad, 1939. p.248. Trans. AS.

46 *Ibid*. p.257.

ВОЗРОЖДЕНИЕ МУЗЫКИ. «ТЕРМЕНВОКС».

„Терменвокс". Л. С. Термен.

Сухо, скупо и., нечутко откликнулась наша пресса на крупнейшее событие истекающего музыкального сезона — демонстрацию Росфилом изумительного изобретения молодого советского инженера Л. С. Термена. Правда—это не абсолютная «новинка»—Термен уже несколько лет тому назад демонстрировал в Москве свою музыкальную «машину» в первой, эмбриональной редакции; правда и то, что с тех пор над аналогичными (или близкими по замыслу) техническими заданиями работает целый ряд ученых и техников Москвы и Ленинграда,—но только Термену и только в последние годы удалось довести свое изобретение до того уровня художественно-музыкальной значимости, который позволяет нам квалифицировать его «лекцию-концерт», как крупнейшее музыкальное событие наших дней.

Перспективы, открываемые музыке изобретением Термена — поистине безграничны. Его «терменвокс» — не просто «новый музыкальный инструмент», как это думает наша музкритика, нет: это решение огромной социально-научно-художественной проблемы, это первый гигантский шаг в будущее, в наше будущее — это социальная революция в музыкальном искусстве, его возрождение.

Вся та «грибная» поросль, о которой недавно на этих страницах так метко и зло повествовал в очередном «письме из Парижа» Л. Сабанеев (№ 18, стр. 14—15)—естественный, конечно, продукт гниения верхнего слоя культурной «почвы» Европы—это тот «пышный мох, разросшийся на гнилом пне», о котором мы уже давно слыхали из уст далеко не «лефа» и не коммуниста—Ромена Роллана.

Работа Термена—первая солидная мина под старый музыкальный мир и одновременно — один из краеугольных камней грядущего-фундамента нового.

— Это будет уже не примитивно-кустарная «симфония гудков!..»

Полная свобода тембровых и интонационных нюансов ведет к

а) расширению европейской тональной системы, загнавшей сегодняшнюю музыку в вышеописанный тупик,

б) смычке с грандиозным искусством Востока, доныне не могшей быть осуществленною из-за тисков 12-ступенной «темперсиции»,

в) небывало-глубокому синтезу с искусством слова, ибо речевые интонации и тембры охватываются диапозоном «терменвокса», и, наконец,

г) созданию совсем новой, неслыханной «дифференциальной (Differenz-Musik) музыки – грандиозных гармонических «glissando» в параллельном и встречном движении,—не говоря уже об обогащении средств даже в пределах старых форм.

Чуткость и точность электро-аппарата позволит, наконец, подойти вплотную и к проблеме «размножения» музыки, ее автоматизации, без неизбежного при этом снижения «качества художественной продукции»—это единственно-реальная возможность истинной «демократизации» музыкального искусства.

Я нарочно остановился лишь на социально-музыкальной проблеме, чтобы подчеркнуть этим массовую недостаточную чуткость нашей музыкальной критики: гоняясь за «марксистским подходом» к музыке по всякому «менее булавочной головки» поводу, равно распинаясь за «Ивана-Солдата» и... Бетховена, она (критика) умудрилась равнодушно пройти—«не приметив»—мимо такого слона, как выступление Л. С. Термена.

АРСЕНИЙ АВРААМОВ.

8

fig 2.1 Article by Arseny Avraamov 'Revival of Music. The Theremin', dedicated to Leon Theremin's concert in Moscow in 1926. *Rabis*, 1927, N.23. Courtesy of Konstantin Dudakov.

2. THEREMIN

REVIVAL OF MUSIC — THE THEREMIN

In 1927, predicting the future of music technology, Arseny Avraamov emphasized the importance of developing 'Radio-Musical Instruments'. He noted in one of his articles:

Our press responded chillily, avariciously and unsympathetically to the largest event of an expiring musical season – Rosfil's[1] *demonstration of the amazing invention of the young Soviet engineer L. S. Theremin.*

Although it is not an absolute 'novelty' – Theremin already showed his musical 'machine' in Moscow several years ago in its first, embryonic edition, it is also the truth that since then a lot of scientists and technicians in Moscow and Leningrad have been working on similar technical projects – but only by Theremin and only in the last years has it been possible to develop his invention to that level of artistic-musical importance which allows us to qualify his 'lecture-concert' as the biggest musical event of our days.

The prospects opened to music by Theremin's invention are really boundless. His 'Theremin' is not a simple 'new musical instrument' as our muscritics [sic] *are thinking, no, it is a solution to the huge social-scientific-art problem; it is the first big step into the future, into our future – it is a social revolution in the art of music, its revival.*

All that 'mushroom-like' young growth, which was recently precisely and angrily described on these pages by L. Sabaneev in his 'Letter from Paris' (#18, p. 14-15) – is a natural product of the rotting of the top layer of the European cultural 'ground', it is that 'magnificent moss, growing on a rotten stump' about which we have already been hearing for a long time from Romen Rollan, who is far from 'LEF'[2] *and not a communist.*

The development of the Theremin is the first real mine under the basis of the former musical world and simultaneously one of the cornerstones of the basis of the future. It won't be a primitive-handmade Symphony of Sirens! The full freedom of timbral and intonational nuances leads to:

- *An extension of the European tonal system, which has brought out today's music in the above mentioned deadlock.*
- *A connection with the grandiose art of the East, hitherto not able to be realized because of the well-tempered twelve-tone system.*
- *An all-time deep synthesis with the art of words, for speech intonations and timbres covering the Theremin range, and, lastly,*

1 Rosfil — Russian Philharmonic society.

2 LEF was the 'The Left Front of the Arts' — a cultural association founded in Moscow in 1922 by Vladimir Mayakovsky, Nikolay Aseev, Osip Brik and others. LEF considered itself as the only true representative of revolutionary art and competed with other proletarian groups. It existed until 1928.

· *The creation of an absolutely new, unprecedented 'differential' music (Differenz-Musik) – grandiose harmonious 'glissando' in parallel and counter movement, without having already mentioned the enrichment of means even within the limits of old [musical] forms.*

The sensitivity and accuracy of the electro-device will, at last, allow close engagement with the problem of the 'duplication' of music, its automation, without an inevitable decrease of the 'quality of art production' – it is a really unique opportunity for the true 'democratization' of musical art. I have purposely stopped only on a social-musical problem to emphasize the absolutely insufficient keenness of our musical criticism: chasing 'the Marxist approach' to music for every 'less than pin head' occasion... it (criticism) has managed to pass by indifferently, 'not having noticed' such an elephant[3] *as the performance of L. S. Theremin.*[4]

LEON THEREMIN

The world is multidimensional in its essence. Mental processes are also multidimensional. Why not demand that models of musical thinking be multidimensional?[5]

Leon Theremin, 1965

Perhaps one of the most charismatic figures in the history of electronic music and audio technology was Leon Theremin (1896-1993), well known as the inventor of the first commercially produced electronic musical instrument, the Theremin (also referred to as the *Termenvox*) (1919-20). As composer and author Albert Glinsky[6] asserts, 'this frequently clumsy instrument was the first foray into the brave new world of electronic music.'[7] Its arrival heralded a new, technologically based trend in the arts. As a physicist, musician and engineer, Theremin worked at the crossroads of creative technology and espionage, developing innumerable projects, often trying to combine music with colour, gesture, scent and touch. It is hardly possible today to imagine any synthesizers, burglar alarms or automatic doors without his pioneering research.

At the same time, although Leon Theremin developed futuristic artistic tools that were perfectly suited to experimental avant-garde practices, he was never involved in any experimental music projects, playing only a traditional classical repertoire. As Thomas Levin asked when describing the most typical application of the new technology in the 1920s and 30s in art and music: 'Is this yet another instance of a radically new technology for the generation of sound attempting to legitimate itself not by foregrounding its own unprecedented sonic capacities but by slavishly simulating well-known classical pieces — as was the case, for example, with the early performances that introduced the technological wonder of the Theremin?'[8] It would be fair to say that Leon Theremin initiated a new technology but not a new aesthetics. Nevertheless his groundbreaking musical invention led not only to the application of the technology for a variety of civilian, military, surveillance and espionage purposes, adding to his status as a cult figure in electronic music in the West, but also provoked new aesthetical trends and discoveries all over the world.[9] Theremin's life story is fascinating and well-documented, not least for his secret work for the NKVD. After gymnasium (secondary school) the young Theremin simultaneously entered St. Petersburg Conservatory as a cellist and St. Petersburg University in the Department of Physics and Mathematics. He finished the Conservatory with a 'Freelance Artist' diploma, but World War I was gathering momentum and his formal education effectively came to a halt. In 1916 he was called up for military service. In 1919, during the Civil War, he spent some time in prison accused of being a participant in the White Guard plot. The same year he was invited by Professor Abram Ioffe to join his Institute for Physics and Technology in Petrograd as head of a new laboratory. It was here, during physical experiments with gases, that the Theremin was invented. In 1921 Leon Theremin performed for a fascinated Lenin, who invited him to tour Russia, promoting the idea of the 'electrification' of the country.

But in fact the range of Theremin's interests was much wider, including experiments into increasing human sensitivity thresholds by means of hypnosis and beyond. Like an alchemist in search of the philosopher's stone, since the 1920s Theremin had been trying to solve the problem of immortality:

I was fascinated with the idea of the struggle against death. I studied... the life of biological cells of animals buried in permafrost. I was interested in what would happen to people if their bodies were frozen and then defrosted again.

Lenin died in 1924. As soon as I found out about it I made a decision: Lenin should be buried in a frozen ground, and in a while I shall restore him! ... I had a reliable assistant whom I sent to Lenin's residence in Gorki to find out how to manage it. He came back very soon: it was too late to do anything. Lenin's brain and heart had already been removed and placed into a vessel with alcohol and thus all cells were already dead. I was strongly affected. It seemed to me that, having obtained Lenin's body, we could understand any defects on a scientific level and restore it. I was ready to do this.[10]

3 Avraamov refers to the popular fable 'Lubopitni' (The Curious) by Ivan Krilov (1814). 'Not to notice an elephant' has the same meaning as 'to visit Rome and not to notice the Pope'.

4 Avraamov, A. 'Vozrozhdenie Muziki. Thereminvox' (The Rebirth of Music. The Theremin) *Rabis*, 1927, No.23, p.8. Trans. AS.

5 Shorthand record of the discussion at the Acoustical Laboratory at Moscow Conservatory. Autumn, 1965. TCA.

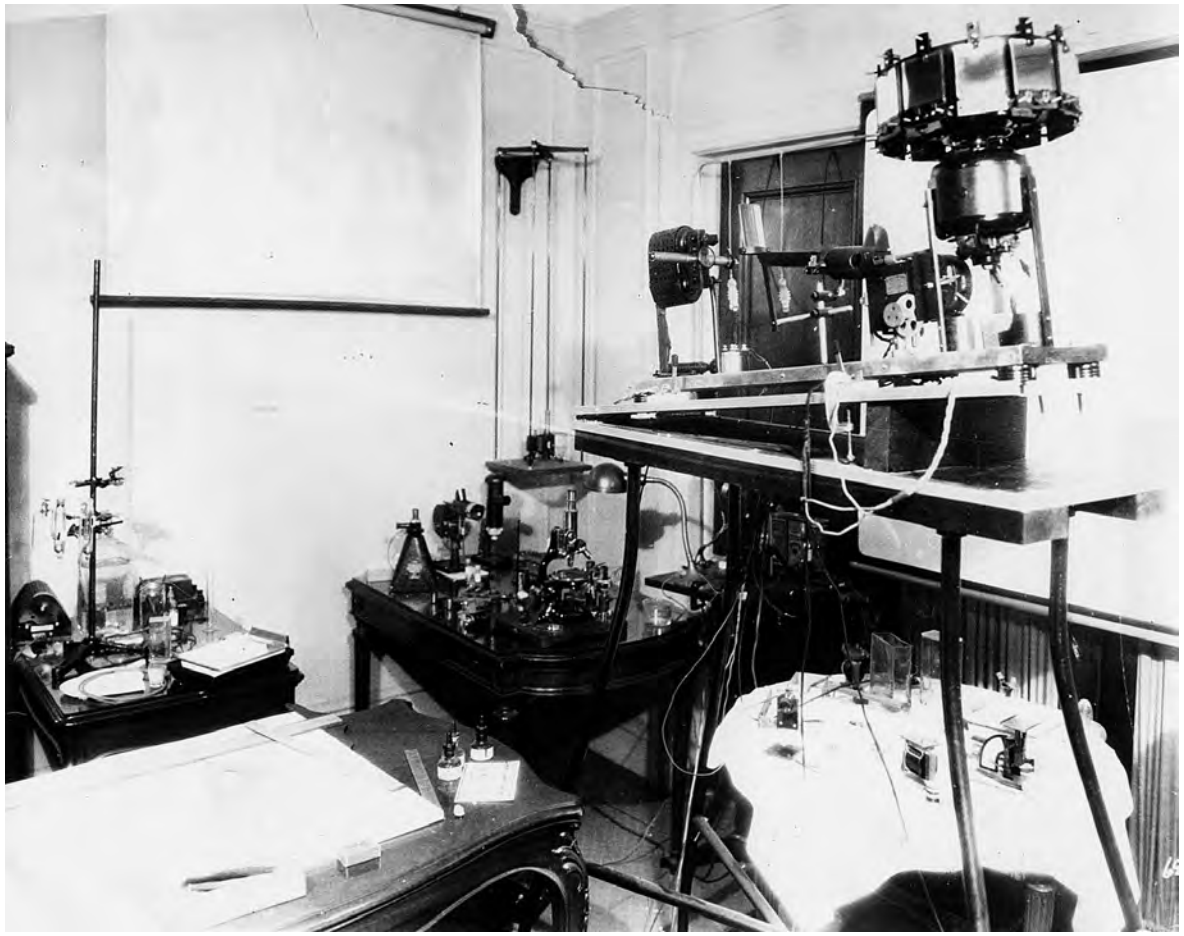
6 Albert Glinsky is the author of the best and most complete biography to date of Leon Theremin, *Theremin: ether music and espionage*. University of Illinois Press, 2000. ISBN 9780252025822.

7 Quoted in Santoro, G. 'Weird Vibes', *The Washington Post*, Washington, D.C., 17 Dec 2000.

8 Levin, T. 'Tones from out of Nowhere: Rudolf Pfenninger and the Archaeology of Synthetic Sound'. *Grey Room 12* (Fall 2003): pp.32-79.

9 The story of Leon Theremin is a good illustration of Solomon Nikritin's concept of Projectionism: in the 1920-30s Theremin's lecture-concerts represented a very clear and inspiring 'projection' of the future methods and prospects of new musical technology provoking the technological research and innovation which led to new aesthetical trends and discoveries.

10 Interview with Leon Theremin by Petrushanskaya, E. 'Lev Termen. Under the Musical Covering'. Music Academy, Moscow, 1995, No.2, pp.60-67. Trans. AS.



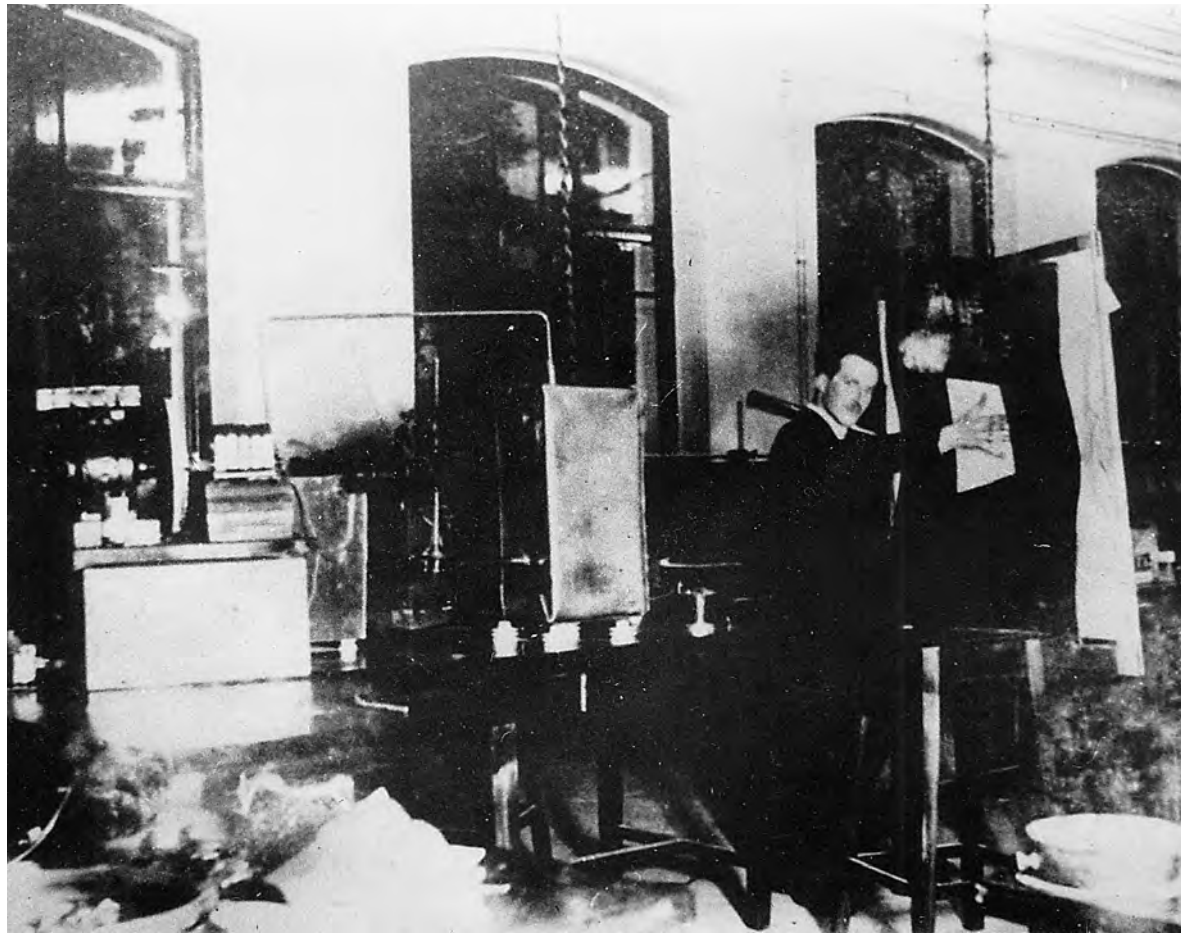
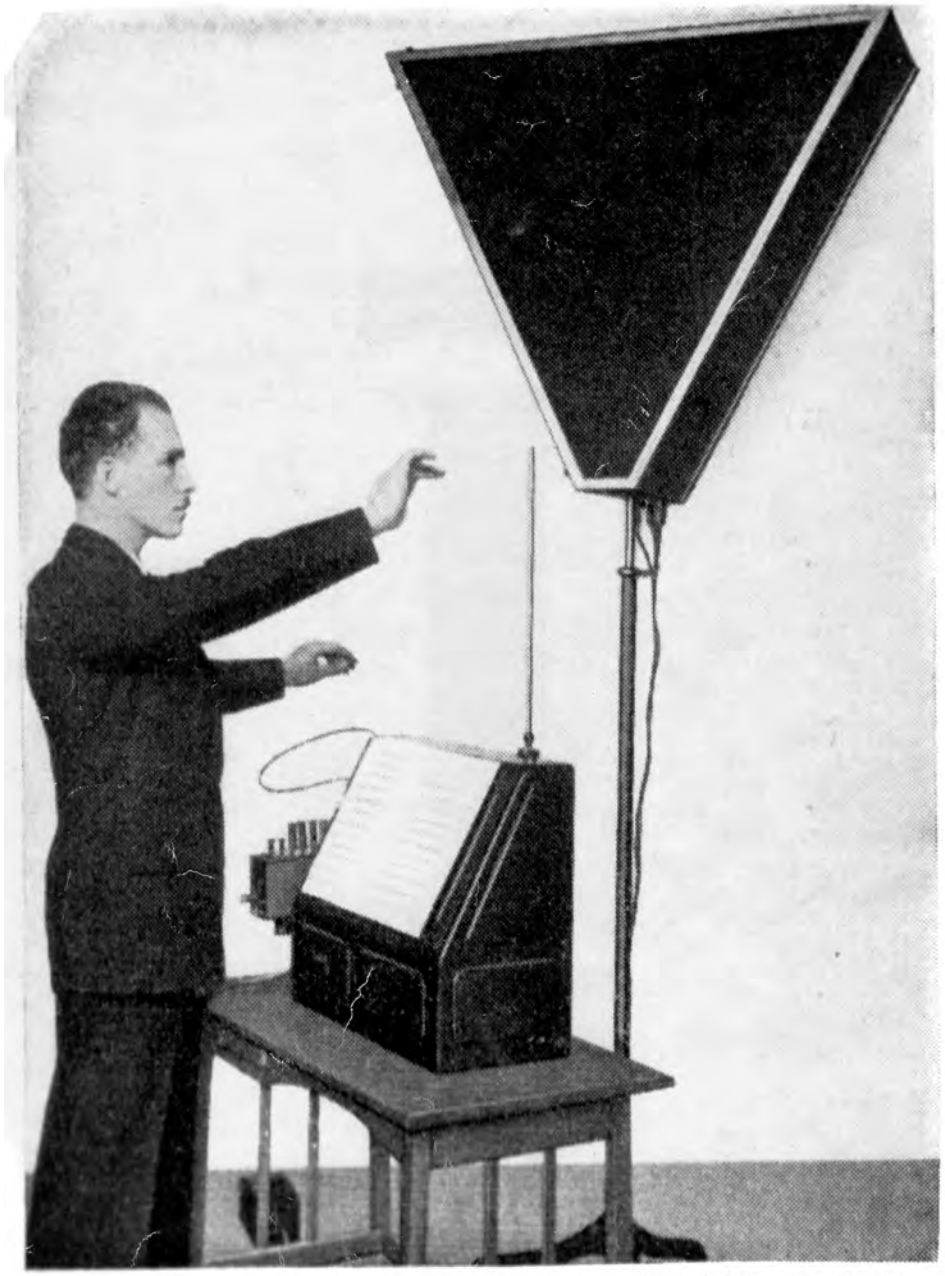


fig 2.2 Left: Experimental model of the distance vision (TV) receiver with interlaced scan — a part of the Dalnovidenie — the first Soviet practical version of the TV system built by Leon Theremin in 1925-26. Courtesy of Lydia Kavina. Right: Leon Theremin in his laboratory working with the distance vision system (Dalnovidenie). c. 1925. Courtesy of Boris Kaplan.



Ätherwellenmusik: Prof. Theremin spielt auf seinem Äther-wellenmusikapparat.

fig 2.3 Leon Theremin playing the Theremin in Frankfurt am Main, Germany. 1927. Courtesy of Lydia Kavina.

fig 2.4 Theremin demonstrating one of his fingerboard models. The position of the left hand on the neck defines the pitch of a sound while loudness is adjusted by the special lever reminiscent of a bow. *Popular Science Monthly*, 1932.

fig 2.5 Poster for Leon Theremin's Lecture-Concert (mentioned in Avraamov's article) in which he declared his intention to combine music with colour, gesture, scent and touch. Moscow, 1926. Courtesy of Sergei Zorin.

fig 2.6 Poster for Leon Theremin's Lecture-Concert on 19 December 1922. Courtesy of Sergei Zorin.

In June 1926 Theremin finished his diploma project *The System of Dalnovidenie (distance vision)* — the first Soviet practical TV system.■ On 1 June 1927, the new Association for the Revival of Music was established in Moscow[11] as an attempt to continue traditions of the Leonardo da Vinci society. It included Leon Theremin — the best musical technologist of the time, the adventurous thinker and theorist Arseny Avraamov as well as the most forward-thinking cultural manager, the commissar Boris Krasin.[12] Shortly after that Theremin's chief professor Ioffe patented the Theremin and managed an international trip for Theremin to Europe and the U.S.A. It was at this time that the project of the Association for the Revival of Music was dropped.

fig 2.2

fig 2.7 The duet of Leon Theremin and Konstantin Kovalsky. Moscow, 1926. Leon Theremin is playing on the new version of the instrument with two antennae, which later became the classic design. Kovalsky is playing on the first version of the Theremin with a single pitch antenna and a button to control volume. Courtesy of Sergei Zorin.

At that time (and after) no international activities could be undertaken without direct supervision from the Soviet intelligence services. Theremin was not an exception. According to his own recollections, he had good financial support from his chiefs — the 'Soviet Military Ministry' as he later called it. His European trip started during the autumn of 1927 with a series of presentations in Germany within the frame of the Frankfurt International Exhibition. Berlin, Paris and London followed. All tickets for his presentation at the Paris Opera sold out in three days; a crowd attacked the entrance and police were called to keep order. According to an article in the *Hamburger Fremdenblatt*, the instrument had 'shortened the path from the human brain to matter', allowing 'a much more adaptable

11 The report of the organizational assembly of the Association for the Revival of Music. Participants: Arseny Avraamov, Boris Krasin, Leon Theremin. The Archive of the State Central Museum for Musical Culture named after M. I. Glinka, ed. khr. 61. List 1.

12 Boris Krasin (1884-1936) composer and influential communist manager. As of 1918 he was the head of the Musical Department of Proletkult and the chairman of the board of the Russian Philharmonic Society among other positions. He was the main supporter of the most experimental projects in music and related technologies, known as a 'commissar of new music'.

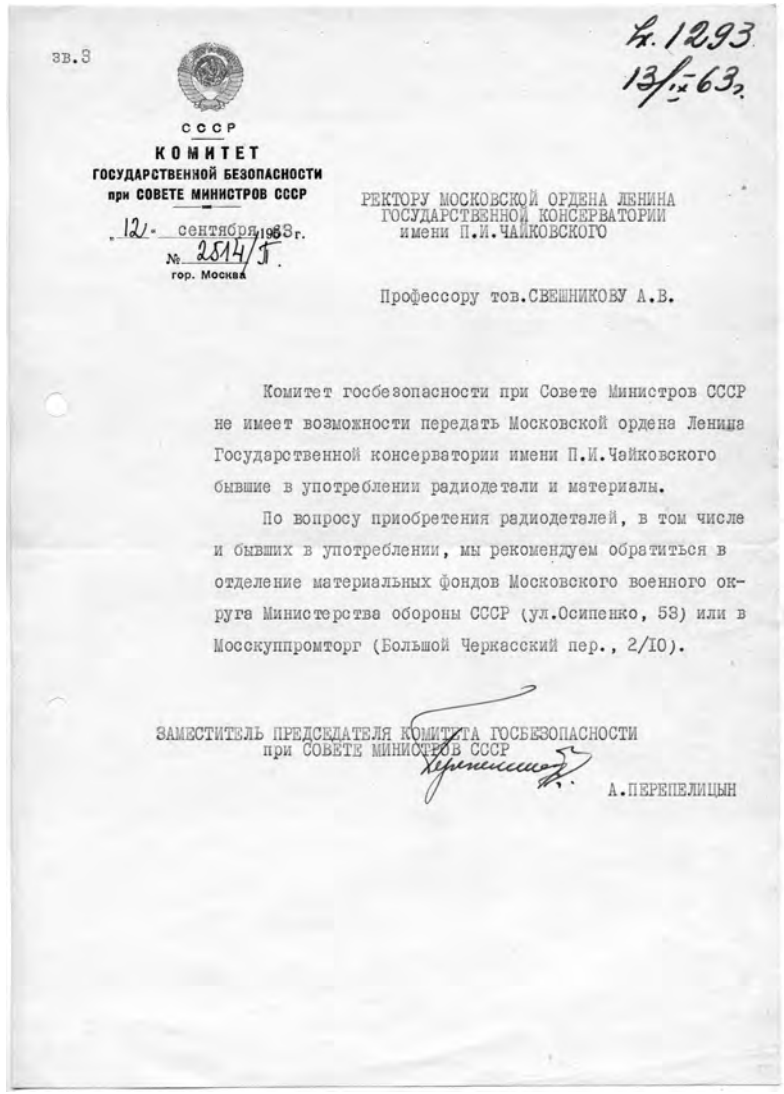
production of music'. A journalist for the *Düsseldorfer Nachrichten* asserted that the invention was 'undoubtedly a turning point in the history of interpretive music'. But while the Theremin clearly created a sensation, for a long time it was largely ignored by most composers.

In his New York studio Theremin was collaborating with many outstanding artists, musicians and scientists, including Leopold Stokowski, Mary Ellen Bute, and Albert Einstein. During this time he developed numerous musical instruments and scientific gadgets. Among them were the commercially available RCA Theremins, the Rhythmicon (the first rhythm machine ever made) and the Terpsitone (a musical platform on which dancers could control sound through the motion of their bodies).

Rescued from creditors and the U.S. immigration service in late 1938, he returned to Soviet Russia.[13] On August 31 1938 he was illegally and secretly (even from his own wife) taken on board the *Starry Bolshevik* ship on which he transported over 1,000 kilograms of electronic equipment to Russia.[14] His intention was to develop an electronic music studio in Soviet Russia. It is not surprising that most of the equipment was confiscated by Soviet customs.[15] On 10 March 1939 he was finally arrested and condemned 'for participation in the counterrevolutionary organization'[16] to eight years hard labour in the stone quarries of the GULAG.[17] Fortunately, after one year in Kolima (a most brutal area in Siberia) he was moved to the Moscow 'Sharaga' — a special NKVD prison for scientists.

A climax point of Theremin's NKVD career came in 1945-47 with the development of the 'Buran' eavesdropping system, supervised personally by both Joseph Stalin and Lavrenty Beria.[18] For this invention, in 1947 just after discharge Leon Theremin was awarded the First Stalin Prize, which was normally inconceivable for a condemned prisoner.

After his release in 1947 he continued working for the NKVD/KGB until his retirement in 1964. It was the only opportunity for him to have access to good equipment, electronic components and technical information. In an epoch of considerable deficiency in the USSR, civil inventors were frequently compelled to steal radio components at military research institutes and factories or to collect them from dumps. In the early 1960s Theremin had been unable to make a rapid switch to the new transistor technology, which caused problems in his relations with his new KGB chiefs. After retiring he moved to the Acoustical Laboratory (formerly NIMI) at Moscow State Conservatory, where in the unpaid position of head of a research group (Soviet regulations prohibited salaries for retired people) he made an attempt to revive his American inventions and research, trying to obtain electronic components through his former connections at the KGB, with little success.



зв.3

СССР
КОМИТЕТ
ГОСУДАРСТВЕННОЙ БЕЗОПАСНОСТИ
при СОВЕТЕ МИНИСТРОВ СССР

12 сентября 1963 г.
№ 2514/5
гор. Москва

К. 1293
13/IX-63 г.

РЕКТОРУ МОСКОВСКОЙ ОРДЕНА ЛЕНИНА
ГОСУДАРСТВЕННОЙ КОНСЕРВАТОРИИ
имени П.И.ЧАЙКОВСКОГО

Профессору тов.СВЕШНИКОВУ А.В.

Комитет госбезопасности при Совете Министров СССР не имеет возможности передать Московской ордена Ленина Государственной консерватории имени П.И.Чайковского бывшие в употреблении радиодетали и материалы.

По вопросу приобретения радиодеталей, в том числе и бывших в употреблении, мы рекомендуем обратиться в отделение материальных фондов Московского военного округа Министерства обороны СССР (ул.Осипенко, 58) или в Мосскуппромторг (Большой Черкасский пер., 2/10).

ЗАМЕСТИТЕЛЬ ПРЕДСЕДАТЕЛЯ КОМИТЕТА ГОСБЕЗОПАСНОСТИ
при СОВЕТЕ МИНИСТРОВ СССР
А.ПЕРЕПЕЛИЦЫН

fig 2.8 Letter from the KGB. During the first year of his work at Moscow Conservatory (1963) Theremin tried to obtain electronic components for his research through his former connections at the KGB. TCA.

Nevertheless his former colleagues recommended several institutes from which it was possible to get written-off, obsolete equipment and components. In April 1967 an article by Harold Schonberg about Theremin was published by *The New York Times*:

13 As yet, no documents have been discovered that give a full explanation of this fact. For instance, in the 1993 documentary on Theremin by Steven Martin, it was implied that he was kidnapped against his will by the Russian secret services and taken back to Russia.

14 According to memories of his granddaughter, Maria Theremin. Conversation with A. Smirnov, August 2005, Moscow.

15 Nevertheless in the photograph taken at the Acoustical Laboratory at Moscow Conservatory in the early 1960s among the newly built instruments an old RCA Theremin can be seen, which could only have been brought to Russia by Leon Theremin himself in 1939. He could not have obtained it by any means later when he was a prisoner or a KGB employee. This fact also indirectly confirms that Theremin left the U.S. both voluntarily and well prepared.

16 Extract from report N26 of the Special Commission at the People's Commissariat of Internal Affairs (NKVD) from 15 August 1939. Published in the book by S. Kovaleva, 'Lev Termen', Moscow, Buro Quantum 2008, p. 190.

17 The term "GULAG" is an acronym for the Soviet bureaucratic institution, *Glavnoe Upravlenie ispravitel'no-trudovykh LAGerei* (Main Administration of Corrective Labour Camps), that operated the Soviet system of forced labour camps in the Stalin era.

18 From 1938-53 Beria was the chief of the Soviet security and secret police apparatus (NKVD) under Joseph Stalin. Beria is known as a most cruel figure in the history of the Soviet Union.

Leon Theremin who used to stand in front of an electronic contraption and conjure otherworldly sounds from the ether. Leon Theremin, the man described by Time *magazine as having 'the most beautiful hands in the world'. Leon Theremin, whose instrument was played in recital by such spectacular ladies as Lucy Rosen and Clara Rockmore. Leon Theremin, the man who gave a concert at Lewisohn Stadium and created a Theremin of such prodigious sound that nobody could hear the orchestra. Leon Theremin, who worked on new sounds with Leopold Stokowski and Henry Cowell.*

Mr. Theremin disappeared from sight shortly before the war, and nothing more was heard of him. Only a few knew whether he was alive or dead.

But he is very much alive. He is a spry, voluble man of 71, and he is a professor of acoustics at the Moscow Conservatory. The other day he took a visitor through his laboratory, talking a blue streak. He is a slim man with a large head and diminishing gray hair. He looks and acts like the prototype of the absent-minded professor.

'I have developed an electronic organ tuner,' he said, pausing before a knobbed, tubed contraption. 'It can tune an organ to any scale, tempered or otherwise.'

'Here,' he said, turning to another collection of tubes and resistors, 'is a machine to photograph sounds. It has seventy channels a halftone [semitone] apart. And here is my Rhythmicon. It can produce any combination of complex rhythms. Let me play you seven against nine. Or would you like to hear five against thirteen? Very important. A conductor can stand here and learn to beat four with one hand and five with the other... Here is a Spectrograph to measure tone colors. Here is a machine to slow up sounds without changing pitch. Now I will show you something special.

'Here is some work I have been doing on the pedals of the piano. With this you can see by colored lines the pianist's pedaling. Very important. We have compared and graphed the pedaling of many great pianists in the same piece. Very interesting... Richter uses more left pedal than most pianists,' Mr. Theremin said.

He ushered the visitor into a room in which a small dance floor had been constructed. Mr. Theremin stood on the floor, raised his arms, made motions, and started to play the Massenet Elegy *on nothing at all. The room was filled with sound, and it was positively spooky. No wires, no gadgets, nothing visible. Merely electromagnetic sorcery...*[19]

This article caused a fast reaction of the kind that was perhaps only imaginable in the USSR: Leon Theremin was removed from his position and exiled from the Moscow State Conservatory. Theremin spent the rest of his life working at Moscow State University as a technician at the Physics Department. Leon Theremin died on 4 November 1993. He had dreamed of being buried in permafrost, to be recovered when science reached an appropriate level, but instead was buried in Kuntsevo cemetery, Moscow.

fig 2.9 Leon Theremin playing on the fingerboard Theremin at the Acoustical Laboratory at Moscow Conservatory. c. 1965. The right hand adjusts the loudness by means of a special lever equipped with a set of buttons to control the timbre by means of additive synthesis. TCA.

fig 2.10 Leon Theremin playing the Theremin in Kazan. 1975. Courtesy of Sergei Zorin.

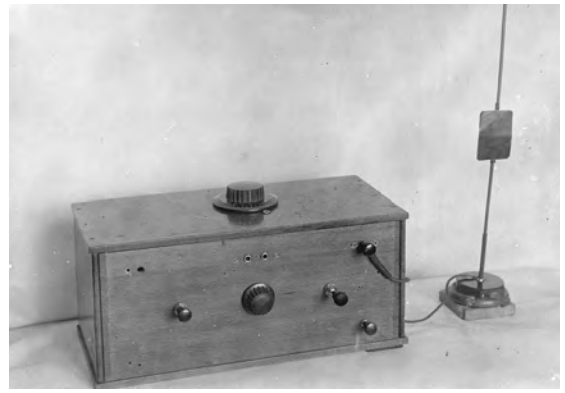
19 Schonberg, H. *The New York Times*, 26 April 1967.

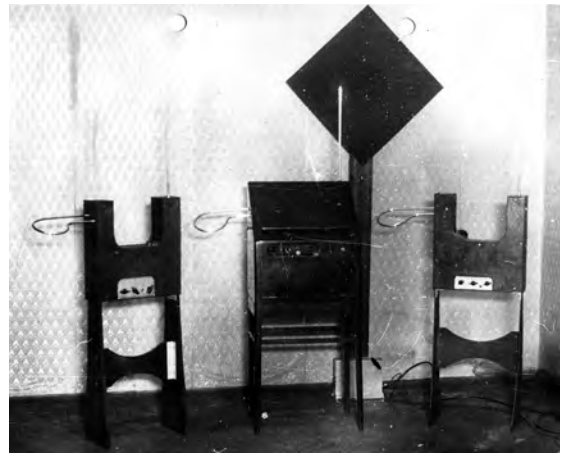
fig 2.11 Leon Theremin. Mid 1920s. Courtesy of Lydia Kavina.

LEON THEREMIN (1896-1993) Russian engineer, inventor and musician, born in St. Petersburg as Lev Sergeyevich Termen. He studied and worked in his native city, attending the Conservatory where he learnt the cello, and University where he studied physics. In 1919 he was director of a lab at the Institute for Physics and Technology in Petrograd where he invented the Theremin, one of the first electronic instruments. In the early 1920s he collaborated with the GIMN institute in Moscow. In 1926 he was sent to Europe to perform concerts and give lectures. In 1927 he moved to New York City; there he developed new musical instruments and other inventions.

In 1938 he abruptly returned to the USSR. Accused of anti-Soviet activities, he was sent to a labour camp. During World War II, however, his talents were in demand and he was transferred to a military laboratory by the name of 'Sharaga'. There he invented various things including submarine tracking systems and eavesdropping devices. In 1947 Leon Theremin was awarded the First Stalin Prize for his 'Buran' eavesdropping system.

After his release in 1947 he continued working for the NKVD/KGB until his retirement in 1964 as an expert on electronics. From 1963-67 he conducted research at the Moscow State Conservatory. After 1967 he worked at the Moscow State University as a technician in the Physics Department. Leon Theremin died on 4 November 1993.





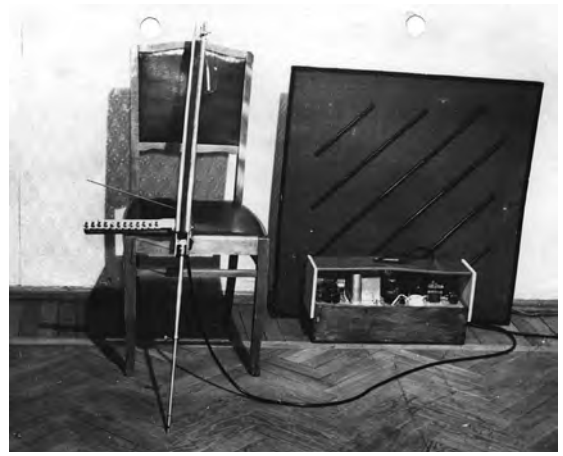


fig 2.12 The very first Theremin, as demonstrated by Leon Theremin at GIMN in 1921. Later it was passed to Konstantin Kovalsky. TCA.

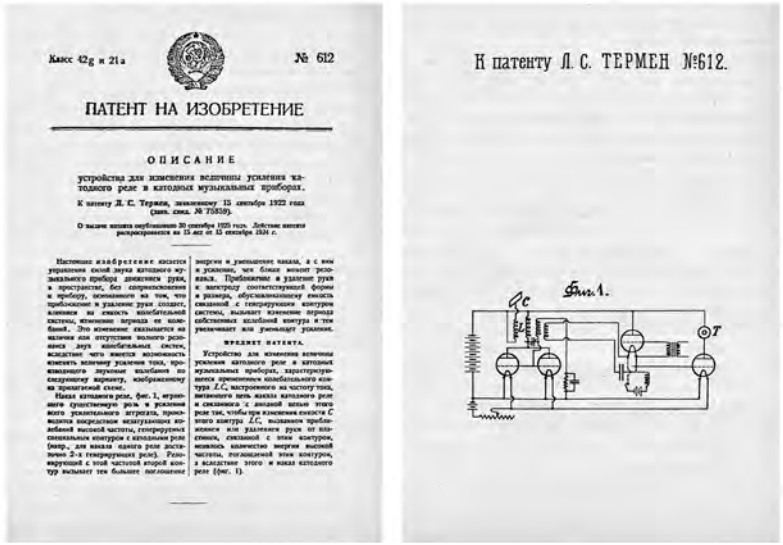
fig 2.13 The Theremins at the Acoustical Laboratory of Moscow Conservatory. In the middle — the RCA Theremin. c. 1960. TCA.

fig 2.14 Last version of the fingerboard Theremin — a musical instrument similar to an electronic cello, constructed by Leon Theremin in 1932 in the US. This version was built by Leon Theremin at the Moscow Conservatory in the mid 1960s. Thanks to additive synthesis, the performer had the flexibility to change the timbre of a sound, controlling separate overtones by means of the keys located on the loudness lever. TCA.

THE THEREMIN

The Theremin (also known as the Aetherphone and the Termenvox) was invented by Leon Theremin in 1919-20. One of the earliest electronic musical instruments, it was the first to be manufactured commercially and the first to be played without being touched.

Theremin realized the possibility of producing pitched sound while fixing a radio station in Russia during the Civil War in 1919. Soon after he was hired by the Institute for Physics and Technology in Petrograd. To measure the dielectric constant of gases with high precision he developed a tool based on the heterodyning principle that could also produce controllable pitched sounds with respect to human body motion. According to witnesses, 'the next day Theremin was playing Gluck[20] on the voltmeter'.



Класс 42g и 21a — № 612

ПАТЕНТ НА ИЗОБРЕТЕНИЕ

ОПИСАНИЕ

устройства для изменения величины усиления катодного реле в катодных музыкальных приборах.

К патенту Л. С. Термэна, заявленному 15 сентября 1922 года (заяв. свид. № 75839).

К патенту Л. С. ТЕРМЕН №612.

Фиг. 1.

fig 2.15 One of the first Russian patents on the Theremin, USSR Patent No. 612, applied for 15 September 1922.

In 1921 Theremin patented the basic principle of operation of his new instrument[21] and in 1922 he patented the method to control volume, normally related to the left hand antenna.[22] In 1924-25 with the help of Professor Abram Ioffe, Theremin patented his instrument in Germany[23] and in the U.S.A.[24]

20 Composer Christoph von Gluck. This reference was a word play; in Russian slang 'gluck' means hallucination.

21 Theremin, L.S. 'Musicalni pribor s katodnimi lampami' (Musical device with cathode valves). Patent No. 780, applied for on 23 June 1921.

22 Theremin, L.S. 'Ustroistvo dlia izmenenia velichini usilenia katodnogo rele v katodnih muzikalnih instrumentah' (Device for control over the amplification of the cathode relay in the cathode ray musical instrument). Patent No. 612, applied for 15 September 1922.

23 Goldberg & Sohne Gmbh (Inventor: Leon Theremin): Process and arrangement for the generation of sounds (musical instrument). German Reich Patent Specification No. 443 536, issued on May 4, 1927, patented since December 9, 1924. Herzfeld, Hugo (Inventor: Leon Theremin): Musical instrument with sound generation through high frequency vibrations. German Reich Patent No. 567 233, issued on December 30, 1932, patented since August 28, 1927.

24 Theremin, L.S. Method of an Apparatus for the Generation of Sounds. U.S. Patent No. 1 661 058, applied for on 5 December 1925, issued on 28 February 1928.

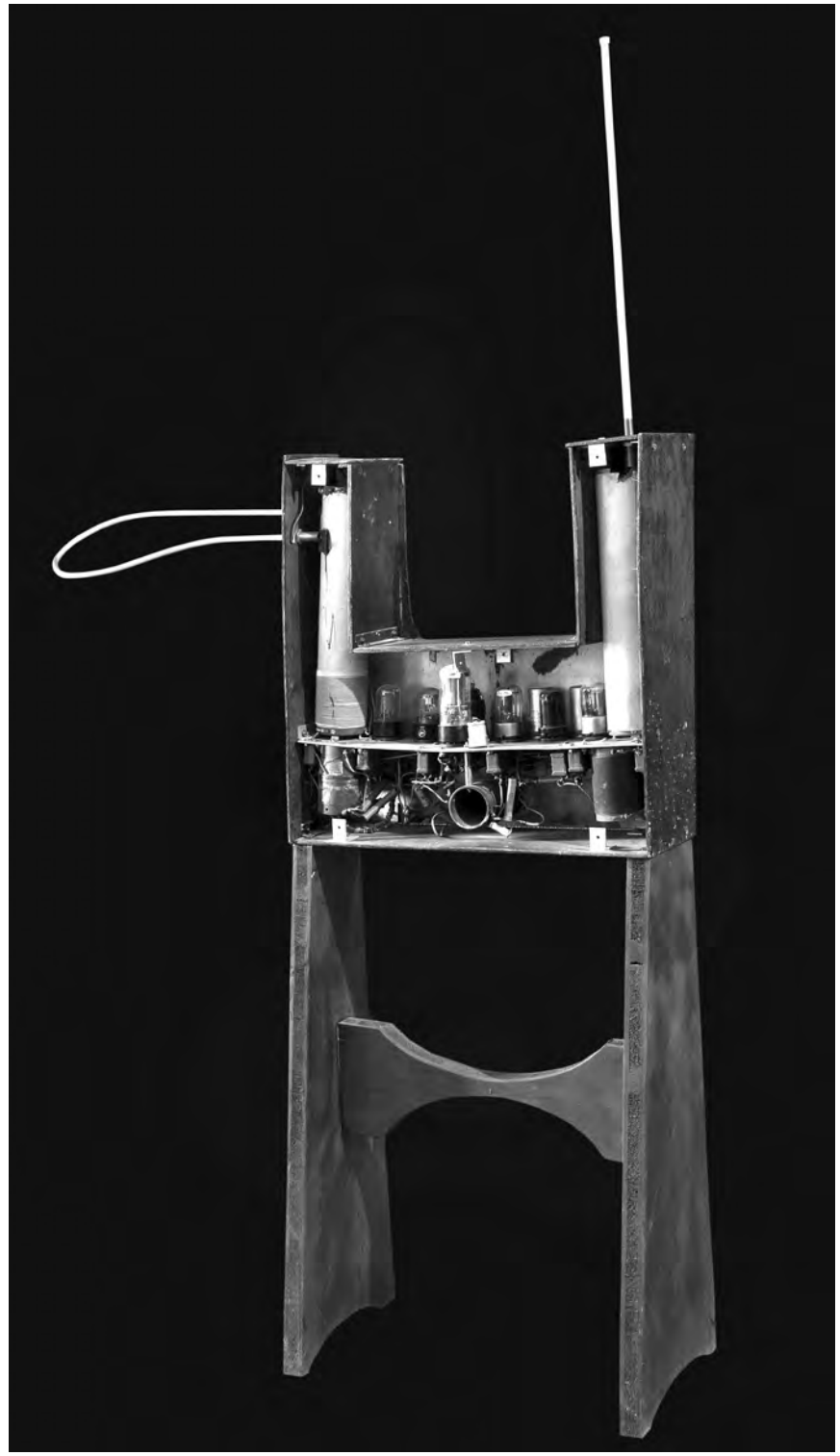


fig 2.16 The Theremin. This version was built by Leon Theremin in the 1950s. The first instrument of this type was built by Theremin in the early 1940s whilst in confinement in the GULAG. Courtesy of AS.

In 1929 America's RCA started to manufacture the Theremin. Released after the Stock Market Crash of 1929, although it was not a commercial success, it fascinated audiences in America and abroad. One electronics enthusiast, Robert Moog (1934-2005), began building Theremins in the 1950s while he was a high-school student. Moog subsequently published a number of articles about building Theremins, and sold Theremin kits which were intended to be assembled by the customer. Moog credited what he learned from the experience as leading directly to his groundbreaking synthesizer, the Minimoog. As he noted, his first love was the Theremin and on the way to rediscovering his first love he invented the synthesizer. As of the late 1980s Moog returned to the Theremin and his Moog Music Company has since sold thousands of Theremins across the world.

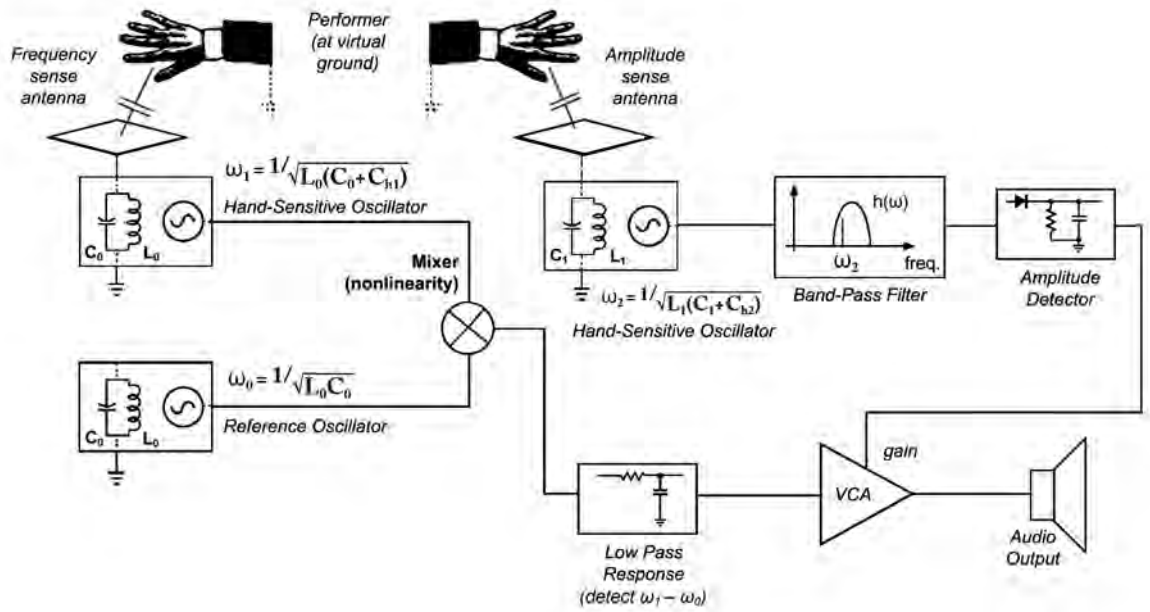


fig 2.17 Schematic diagram of the Theremin. The audio frequency vibration is produced by heterodyning the outputs of two ultrasonic oscillators, one fixed and one variable. In the classic Theremin design the fixed oscillator operates in the region of 250 KHz with the variable pitch oscillator being above this frequency, the difference equalling the frequency of the note being played. The position of the right hand is sensed by the change of electric capacitance it introduces in the pitch antenna, and this change controls the frequency of the variable pitch oscillator. The left-hand circuitry derives a control voltage from the volume antenna, this voltage being used to control the gain of the voltage controlled amplifier and hence the amplitude of the output. The resulting output is processed to give more complex waveforms that provide a choice of tone colours. Diagram by A. Smirnov.

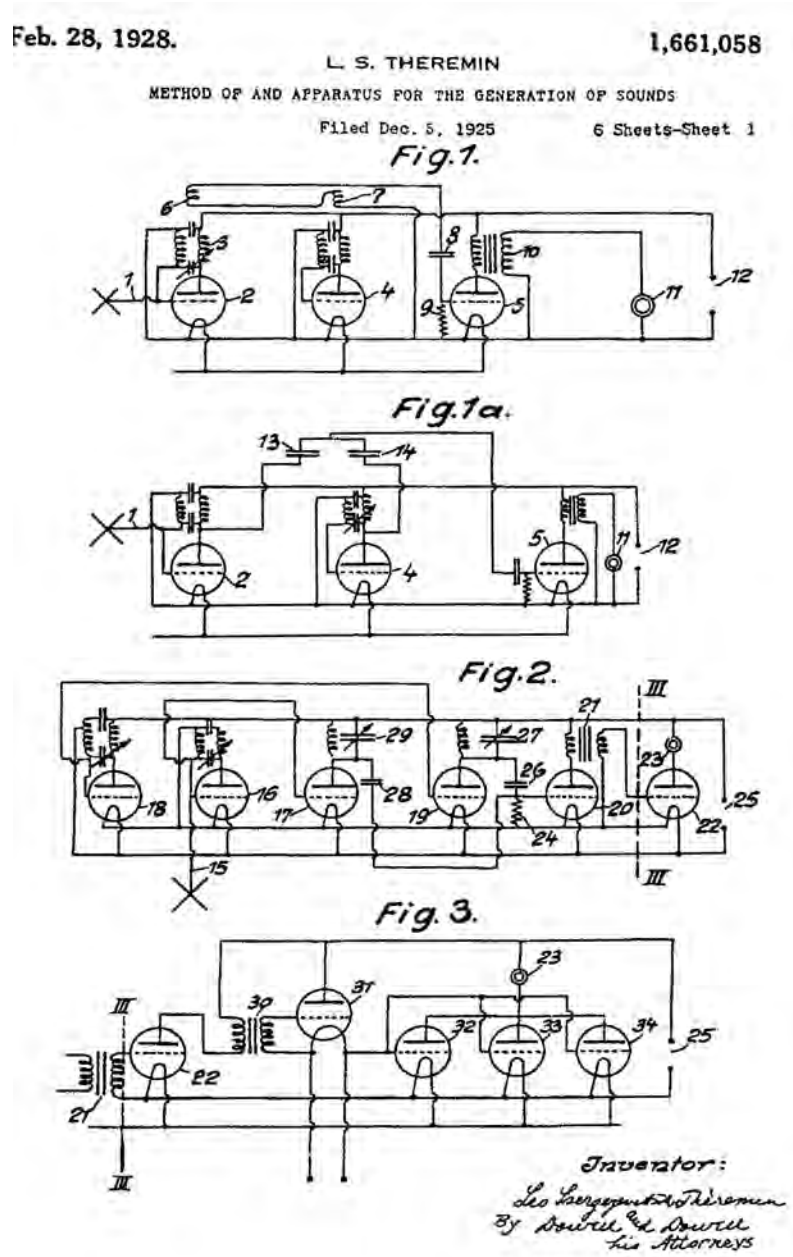


fig 2.18 The American patent on the Theremin, U.S. Patent No. 1 661 058, applied for on 5 December 1925, issued on 28 February 1928.

fig 2.19 The Terpsitone, performed by Clara Rockmore, Carnegie Hall, April 1932. *Popular Science Monthly*, 1932.

THE TERPSITONE

The Terpsitone is a variation on the Theremin, but instead of an antenna for the hand it uses an antenna-platform for the whole body. Dancers' movements are converted into corresponding tones — moving an arm or a leg is sufficient to produce a noticeable change of tone. It was one of the first motion-tracking systems, and was developed independently of Alexei Gastev and Nikolai Bernstein's research (see Chapter 3).

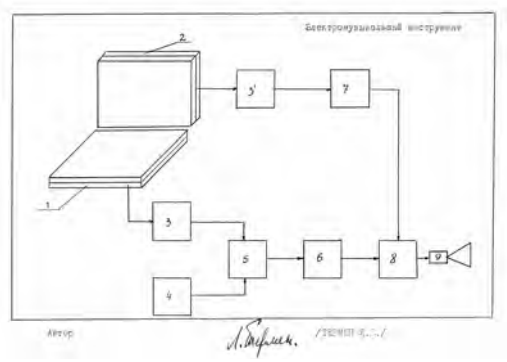


fig 2.20 Block diagram of the Terpsitone. Appendix to the proposal for the invention. TCA.

During the 1930s Theremin developed several versions of the Terpsitone with extended capabilities. Besides the pitch antenna, a volume antenna was built within a construction holding a loudspeaker behind the dancer to control volume by changing the distance from the body to the volume antenna. Some Terpsitones had special tools to reproduce background music while the dancer was performing a solo part. Another feature was an automatic coloured light accompaniment. The 'visual note indicator' was a panel of lamps of different colours. This, however, was accomplished by a partly mechanical method: a tuned reed behind each lamp vibrates when its corresponding note is sounded, and thereby closes the circuit lighting its lamp. Thus the notes evoked by the artist's motions were shown by lights flashing simultaneously up and down the panel, one for 'A' another for 'C' and so on.

Built by Theremin in the early 1930s it was demonstrated at Carnegie Hall in 1932. According to the press: 'By means of Prof. Theremin's latest device, a dancer may create music by the movements of her body. A capacity device in the floor is mainly responsible... The inventive genius of Professor Leon Theremin has at last justified a famous poet in his license. Many years ago, Tennyson wrote: "The dancers dancing in tune".'[25] Despite its conceptual beauty, it was hard to 'dance in tune' since musical appreciation and artistic movement are so different. The Terpsitone was first performed by Theremin virtuoso Clara Rockmore, who had perfect pitch and a supple body.

Several Terpsitones were built in the US and a group of dancers worked with them with notable success. Leon Theremin married one of the dancers — Lavinia Williams. The last Terpsitone was built by Theremin in 1978 for Lydia Kavina and is now located at the Theremin Centre at Moscow State Conservatory.

25 Theremin, L.S. 'Terpsitone: A New Electronic Novelty'. *Radio Craft*, December 1936, p.365.

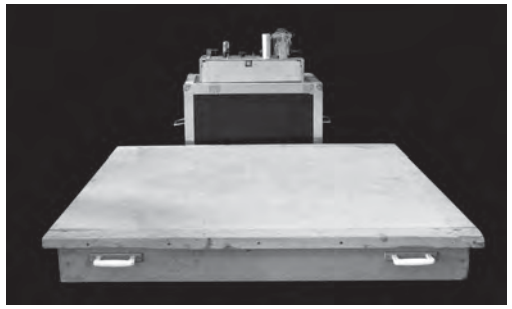


fig 2.21 The Terpsitone. Version built by Leon Theremin in the mid 1960s at Moscow Conservatory. TCA.

fig 2.22 The last Terpsitone, built by Leon Theremin in 1978. TCA.

fig 2.23 The last Terpsitone, built by Leon Theremin in 1978, performed by Lydia Kavina at the Theremin Centre, Moscow in 1995. TCA.

THE RHYTHMICON

The Rhythmicon, also known as the Polyrhythmophone, was the world's first rhythm machine. It was developed by Leon Theremin by the end of 1931 and was presented for the first time on the 19 January 1932 at the New School for Social Research in New York, where the avant-garde American composer and musical theorist Henry Cowell was in charge of musical activities.

Not long before this Cowell had included in the third movement of his *Concerto for Piano and Orchestra* (1929) a passage which combined the rhythms of three, four, six, eight, twelve and sixteen. This movement was titled 'Counter Rhythm', which was almost impossible for one person to perform simultaneously by traditional acoustical means. Cowell wanted an instrument with which to play compositions involving multiple rhythmic patterns and in 1930 he commissioned Theremin to create the remarkably innovative Rhythmicon. The project was financially supported by Charles Ives and realized in collaboration with Russian composer and theorist Joseph Schillinger.

fig 2.24 The interior of the third version of the Rhythmicon, built in Moscow in 1965. TCA.

In 1932 Henry Cowell wrote a letter to his stepmother, describing his contribution to the design of the Rhythmicon:

My part in the invention was to invent the idea that such a rhythmic instrument was a necessity to further rhythmic development, which had more or less reached the limit of performance by hand, and needed

the application of mechanical aid... the relation between the pitch and rhythm is my idea. I also conceived that the principle of broken-up light, playing on a photoelectric cell, would be the best means of making it practical. With this idea I went to Theremin, who did the rest.

He invented the method by which the light could be cut, did the electrical calculations, and built the instrument. The purpose of the instrument is twofold: to make possible the production of rhythm and related tone beyond the point where they could be produced before now by any known means; and to be used, first, for making rhythmical melody and harmony for use in musical composition, and second, for the carrying on of numerous scientific physical and psychological experiments with rhythm.[26]

It is interesting to note that by coincidence an instrument with a similar design and based on the same principles had already been patented in 1925 in Russia by I. Sergeev.[27]

fig 2.25 The third version of the Rhythmicon, built in Moscow in 1965. TCA.

The first Rhythmicon produced up to sixteen different basic rhythms — a periodic base rhythm on a selected fundamental pitch and fifteen increasingly rapid rhythms, each associated with an ascending note of the fundamental pitch's harmonic series. Like the harmonic series itself, the rhythms follow an arithmetic progression, so that for every single beat of the fundamental, the second harmonic (if played) beats twice, the third harmonic beats three times, and so forth. Using the device's keyboard, each of the sixteen rhythms could be produced individually or in combination, forming almost innumerable possible rhythms. Joseph Schillinger calculated that it would take 455 days, 2 hours and 30 minutes to play all the combinations available on the Rhythmicon, assuming an average duration of ten seconds for each combination.

Henry Cowell wrote a number of compositions for it, including *Rhythmicana* (*Concerto for Rhythmicon and Orchestra* (1931)) and *Music for Violin and Rhythmicon* (1932). Nevertheless the instrument was never really used in musical performance since it had several serious drawbacks that were probably consequences of a contradiction between a beautiful technical concept and real musical necessity. The Rhythmicon could produce only very short sounds which were almost inaudible on low pitches. But the main problem lay in the absolute impossibility of starting the rhythm from the first measure since by pressing the keys one controls only the volume of continuously circulating rhythm patterns.

One of the original Rhythmicons ended up at Stanford University; the other stayed with Russian-born American composer and critic Nicolas Slonimsky, from whom it later passed to Schillinger and then to the Smithsonian Institution. In the early 1960s at Moscow State Conservatory, Theremin built a third, more compact model. It was made of junk since, as previously mentioned, in the USSR in the 1960s electronic parts were not readily available — inventors had to steal or salvage them. This version of the instrument now resides at the Theremin Centre in Moscow and is still in working order.■

figs 2.24-25

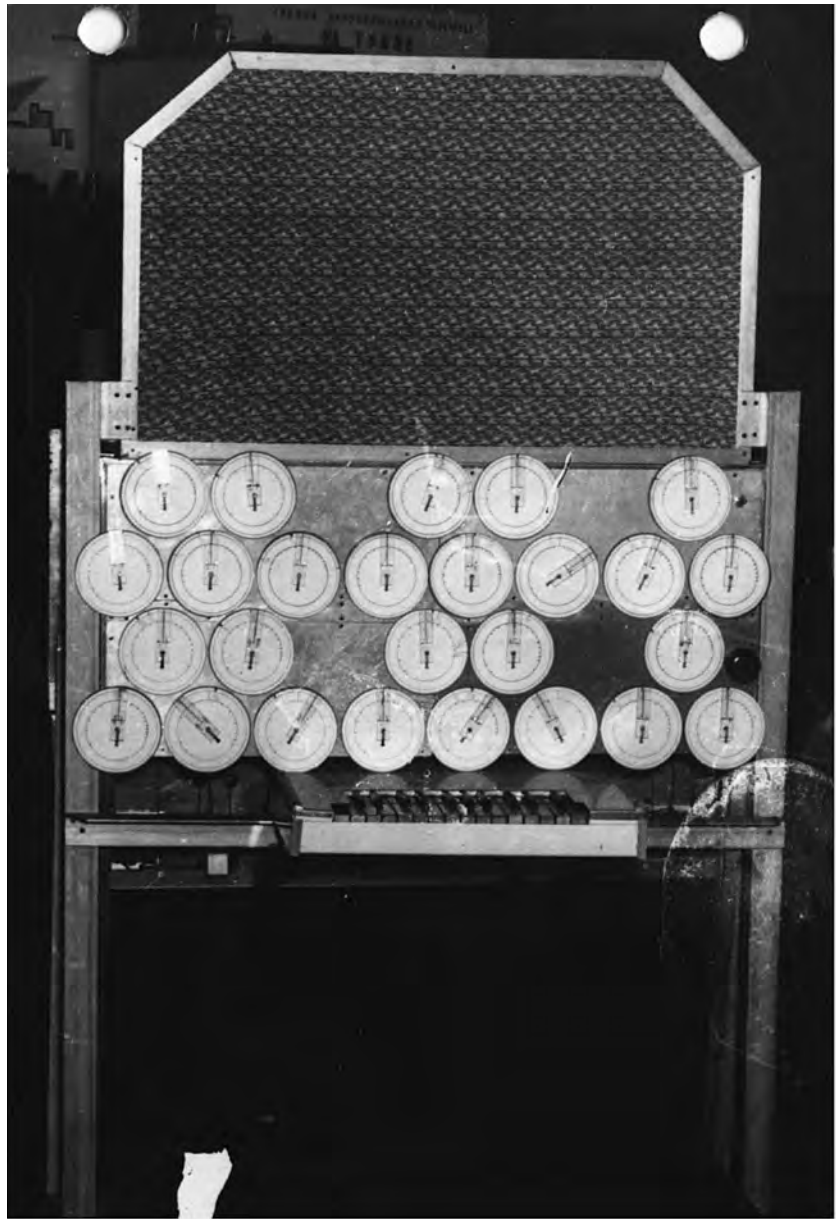
fig 2.26 A Harmonium made by Theremin in the 1960s. TCA.

THE HARMONIUM

While Arseny Avraamov, Pavel Leiberg and other researchers were exploring the harmony of microtonal music, Theremin was interested in the psychoacoustical nature of human perception of complex musical intervals, as well as in spatial sound perception. In the 1930s in New York and in the 1960s at Moscow State Conservatory, Theremin built several experimental electronic harmoniums that superseded the old acoustical instruments of Avraamov and GIMN. The most used microtonal harmonium, which was built at Moscow State Conservatory in 1965, was oriented towards the subjective human perception of sounds (psychoacoustics) in relation to complex

26 Smith, L. 'Henry Cowell's Rhythmicana', *Yearbook for Inter-American Musical Research*, Vol.9, 1973, pp.134-147.

27 Sergeev, I. A. 'Electrichesky muzikalni pribor' (Electrical musical device). Patent No. 12 625, applied for 21 March 1925.



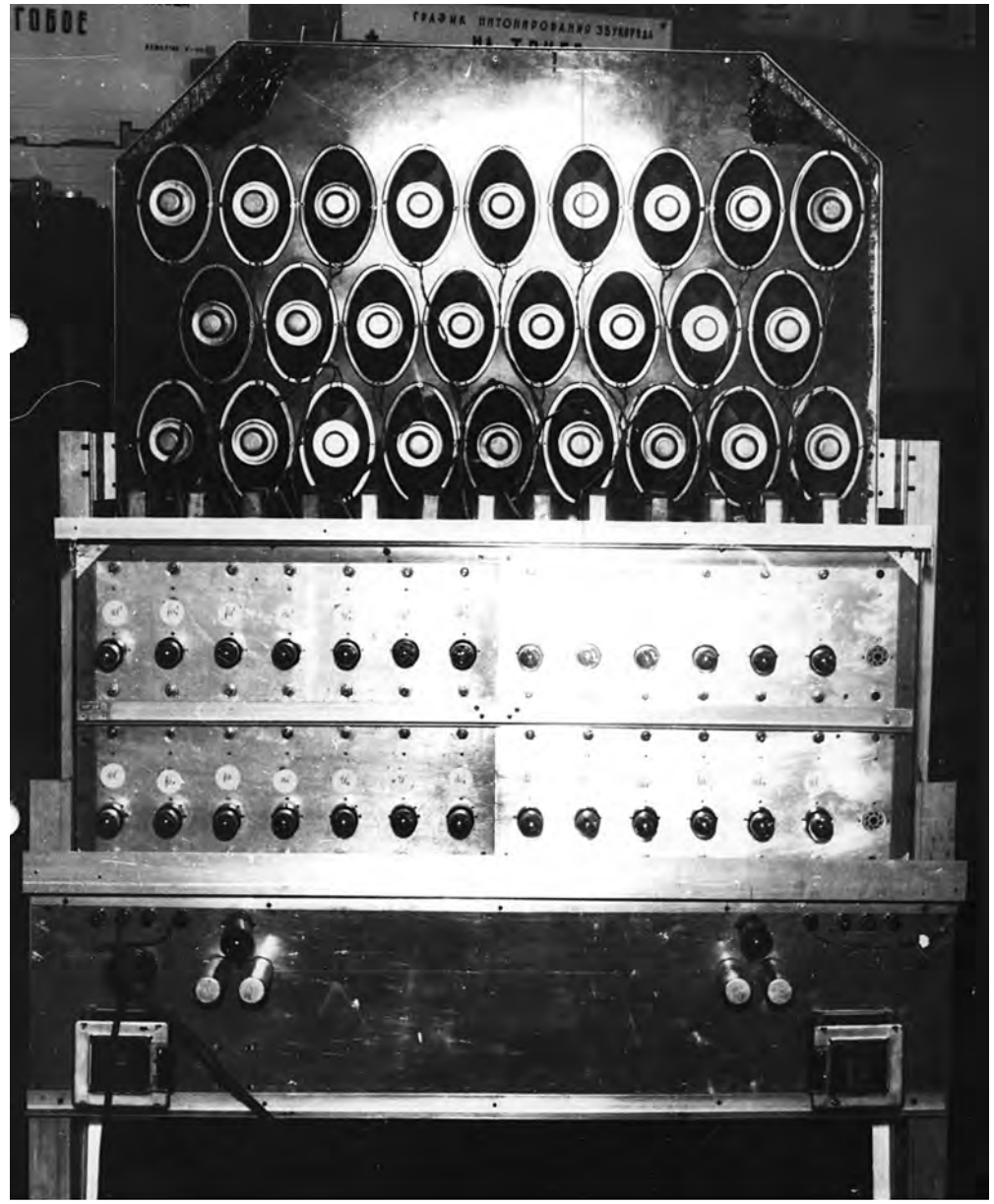


fig 2.27 (L + R images) A Harmonium, made by Theremin in 1965, intended for experiments with the spatial perception of complex clusters of spatially separated tones with arbitrary pitches and interval inter-relations. TCA.

musical intervals as experienced in physical space. In this instrument each oscillator has an independent pitch control and loudspeaker. Listening to the sounds produced by this instrument allows people to experience the final 'mix' directly in their brains. Any beats or sub-harmonics appear as pure psychoacoustical phenomena — the result of interpretation by the mind. For many years this instrument was used for training choir conductors and singers.

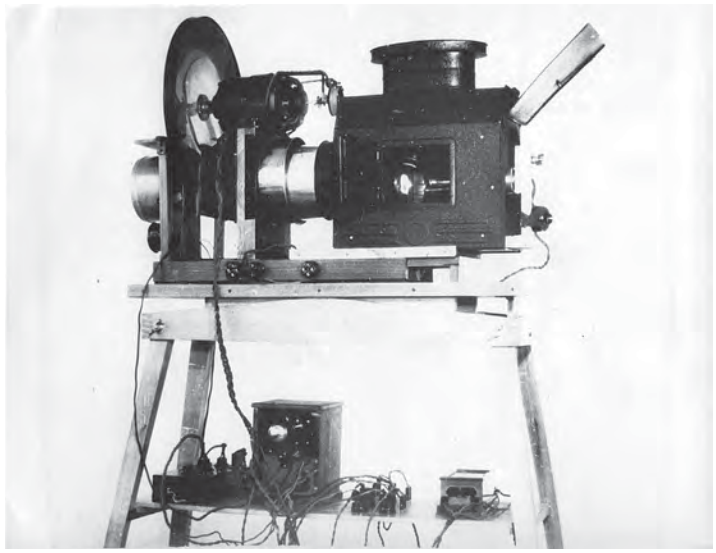


fig 2.28 Ilumovox — the Light Theremin. An instrument for controlling the colour of a light beam during a musical performance. Petrograd, 1923-24. Courtesy of Lydia Kavina.

VISUAL MUSIC

In 1923 Leon Theremin built the Illumovox. It was an instrument for controlling the colour of a light beam during a musical performance by different means including body movement and gesture. It was widely used in numerous experiments and shows. The basic operating principle of the Illumovox was also utilized in different versions of Terpsitones, the polyphonic Theremin and even in the construction of a scientific device for tracking the movement of piano pedals. It served as an artistic visual extension of a performance as well as a kind of visual indicator of the performance. In fact the range of Theremin's interests was even wider, including experiments into increasing human sensitivity thresholds by means of hypnosis and beyond. In this context research into the human perception of multilayered multimedia art forms gained special importance. Theremin recollected in one of his articles:

As of the 1920s the author was engaged in the development of light-music devices which he demonstrated at concerts in the Soviet Union, Germany, France and the USA during the period 1922–39. Light effects accompanying the melody were achieved by means of light projection on the performer's body with a colour corresponding to the pitch of the sound and the brightness changing proportionally to the intensity of the sound.

The author conducted experiments following the demonstration of coloured stroboscopic images with symmetry corresponding to the harmonious steps of a melody that provided interesting entertainment results.

Albert Einstein, who was involved in the activities of Leon Theremin's colour-music laboratory in New York, was engaged in the presentation of geometrical colour figures accompanied by music. Later he participated in research conducted by the laboratory's collaborator Mary Ellen Bute (the well-known modern American director of abstract film).

The subsequent colour-music presentations were approved by the audience and received positive reviews. Further experiments were conducted by the author by means of electronic schemes and the polarised optics (1939).

The author also carried out experiments on the application of various methods of light projection by means of different light sources, taking into account features of psycho-physiological influence on spectators and listeners. The strong influence of the high-rise and lateral displacement of the light projections was noted. A very slow lowering of the projection along the auditorium walls resulted in a sensation of lifting or launch, while return displacement of a projection – a sense of falling at various speeds. At the same time coincidence of movements with structures corresponding to melodic and harmonious design created a very strong psycho-physiological influence.

A long-term projection of light dots with variable intensity and chromaticity combined with musical soundings leads to a quasi-hypnotic influence on some listeners. The application of stereoscopic (three-dimensional) structures and their variations provides a substantial increase of psycho-artistic influences (in comparison with the use of a usual plane projection).

Experiments on the coordination of colour-light perceptions with various degrees of rhythm were conducted by means of the Rhythmicon which could generate fluctuations of rhythm in the range of one to twelve beats per measure, reproduced with pitches, corresponding to rhythm number. It was noticed that the audience demonstrates an increase of artistic involvement as a result of the perception of poly-rhythmic soundings combined with optical processes with a colour system based on three- and five- component schemes.

Currently the Laboratory of Leon Theremin is conducting experiments into the coordination of harmony of the sounding of the polyphonic Theremin with chromaticity, corresponding to steps of melodic tones.[28]

EAVESDROPPING AND MICROWAVE ATTACKS

On 4 August 1945, the Young Pioneers (an association of Soviet school-age children) presented a carving of the Great Seal of the United States to U.S. Ambassador Averell Harriman. It hung in the ambassador's

28 Theremin, L.S. 'Eksperimenti v oblasti svetomuziki v laboratorii L.S. Termena'. (Experiments in the field of colour-music in the laboratory of L.S. Theremin). Documentation from the conference 'Svet I muzika' (Light and music), Kazan, 1979. p.19-20. Trans. AS.

Moscow residential office until 1952 when the State Department discovered that it was 'bugged'. According to Henry J. Hyde, a Republican Congressman from Illinois who was on the Intelligence Committee: 'It hung prominently for years'.[29] In his report, Hyde cited American diplomat George Kennan's record of the discovery: 'The ordinary, standard devices for the detection of electronic eavesdropping revealed nothing at all, but technicians decided to check again, in case our detection methods were out of date...

fig 2.29 The Great Seal wall plaque. Left: front view of the carving. Right: cutaway view showing concealed trench containing Theremin's passive resonant cavity transmitter. Courtesy of thespymuseum.com, and H. Keight Melton, *The Ultimate Spy Book* (New York: DK Publishing, 1996).

Quivering with excitement, the technician extracted from the shattered depths of the seal a small device, not much larger than a pencil... capable of being activated by some sort of electronic ray from outside the building. When not activated, it was almost impossible to detect... It represented, for that day, a fantastically advanced bit of applied electronics.' [30]

This came to the attention of the world when it was displayed at the United Nations in May 1960. It was a real microwave Theremin — a cylindrical metal object that had been hidden inside the Great Seal and was known among Soviet experts as Zlatoust ('Golden Mouth').

At first, Western experts were baffled as to how the device, which became known as 'the Thing', worked, because it had no batteries or electrical circuits. Peter Wright of Britain's MI5 discovered the principle by which it operated. It held buried inside it a small cylinder called a Hi-Q resonant cavity. The cylinder contained a diaphragm at one end and an antenna at the other. Voices in the room caused the diaphragm and then the antenna to vibrate. The device did not demand power supplies, receiving energy from the directed microwave radiation used simultaneously for transferring the information. U.S. officials surmised that Soviet technicians across the street kept a high-power microwave beam trained on the seal to measure the vibrations, allowing them to reconstruct the conversations. MI5 later produced a copy of the device (codename SATYR) for use by both British and American intelligence.[31]

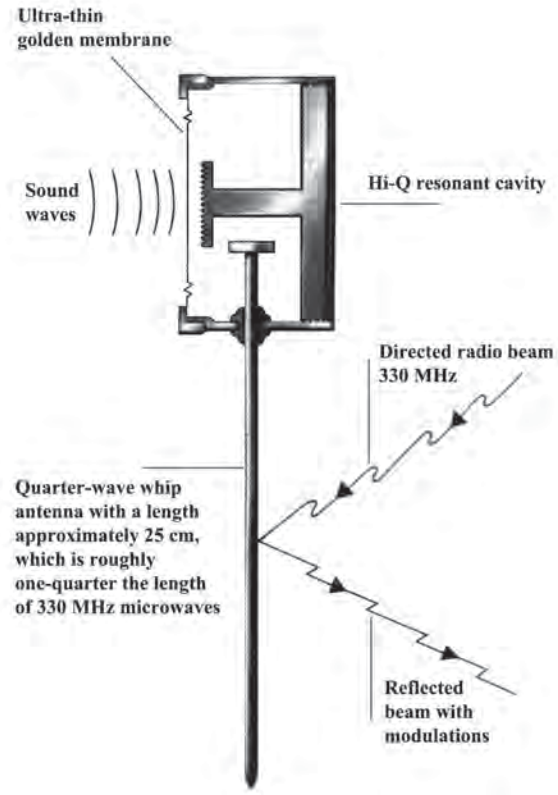


fig 2.30 Principle of the working of the Great Seal Bug system, which was a type of microwave Theremin. The device did not demand a power supply, receiving energy from the directed microwave radiation used simultaneously for the transfer of information. Diagram by A. Smirnov.

Around ten years later the national news media revealed that there was a serious health risk for employees of the U.S. Embassy in Moscow posed by the continuous bombardment of the building by microwaves. It was mentioned that the exposure resulted from the microwave beams of eavesdropping devices operated by Soviet intelligence agencies. In fact this problem was also caused by another of Theremin's inventions, made in 1947 and named Buran. At that time he was using 330 MHz microwave radiation [32] directed onto windowpanes, which then behave

29 Hyde, H.J. introduction to 'Embassy Moscow: attitudes and errors'. Congressional Record. 25 October 1990, House of Representatives. p.E3489.

30 Kennan, G.F. 'Memoirs, 1950-1963, Volume II' Little, Brown & Co., 1972, pp.155-156. Cited in Henry J. Hyde, introduction to 'Embassy Moscow: attitudes and errors'. Congressional Record. 25 October 1990, House of Representatives. p.E3489

31 http://www.spybusters.com/Great_Seal_Bug.html

32 The use of microwaves at the Embassy — in a similar way to Theremin's Buran system — was, for instance, reported in *TIME* Magazine: 'FOREIGN RELATIONS: The Microwave Furor', Monday, 22 March 1976: '"Why not go public and embarrass them for a change?" demanded an irate former Moscow diplomat last week. He was referring to Washington's curious reticence about the great Moscow microwave furor. Last month the U.S. confirmed that for some fifteen years the Soviet Union has been beaming microwaves at the hulking nine-story U.S. embassy on Moscow's Tchaikovsky Street (*TIME*, Feb. 23). The purpose: to jam the sophisticated electronic monitoring devices inside and on the roof of the building. (An earlier theory, now taken less seriously, was that the microwaves were designed to activate or charge up Soviet bugs planted within the embassy.) The U.S. has also confirmed that last May the microwave dosage suddenly increased sharply.'

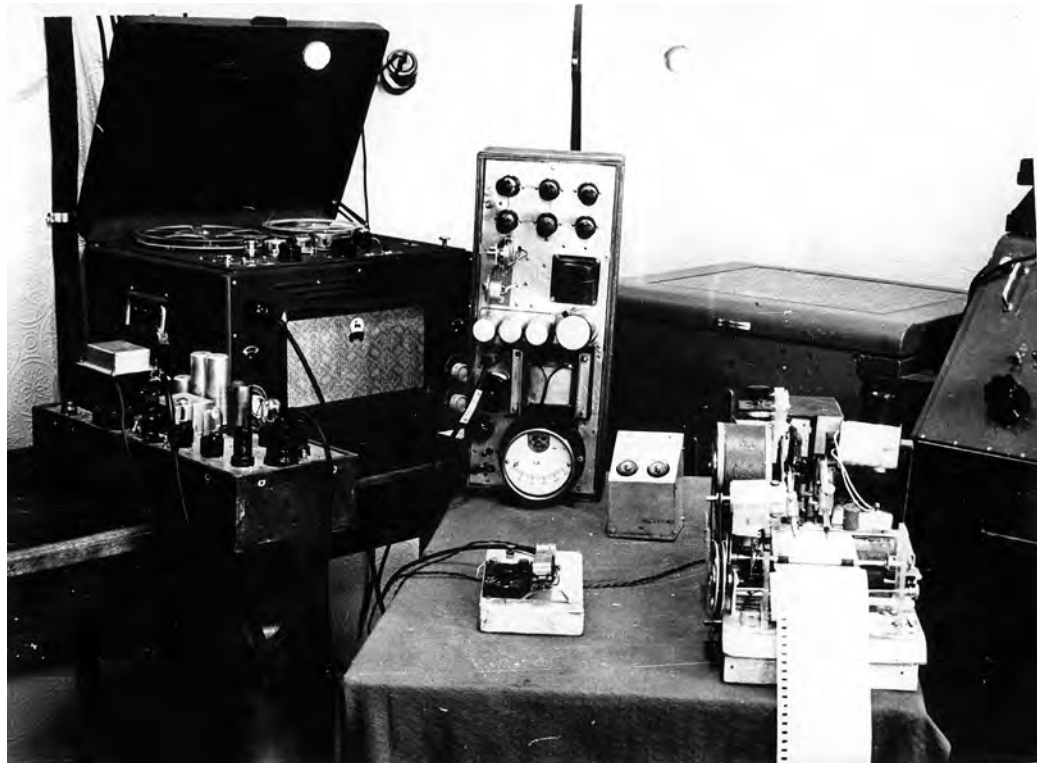
like microphones: sound vibrates the surface of the window and produces a phase modulation in the reflected beam. The interferometer and photodetector in the receiver convert the obtained fluctuating interference patterns to voltage fluctuations, which are electronically manipulated and reconstituted as sound.

fig 2.31 Leon Theremin at the conference of piano adjusters, Moscow, 1966. In the first row, second from the left is Leon Theremin; third from the left is Georgy Bogino. TCA.

EAVESDROPPING ON PIANISTS

During his many years working for the KGB, Theremin was involved in the development of various eavesdropping systems, some of which were the most advanced in the world at the time. After retiring from the KGB, working at Moscow State Conservatory, Theremin continued his 'secret' research. In 1965-66 in collaboration with one of the best Russian piano adjusters, Georgy Bogino, Theremin developed a system that was hidden under the pedals of the concert piano in the Bolshoi Concert Hall at Moscow State Conservatory (the most prestigious music hall in Russia). The system was capable of monitoring piano pedal movements during live performances. Being wireless, this gadget could transmit data behind the stage in complete secrecy. A lot of unique and significant data was received and studied. Many leading international pianists including Sviatoslav Richter, Emil Gillels, and John Ogdon were under investigation.

Working at Moscow Conservatory, Theremin made numerous inventions for which he tried to obtain patents — the majority of them, including the most innovative ones, were refused. The piano pedal monitoring system was one of only a few of Theremin's inventions to be officially patented and put to use.



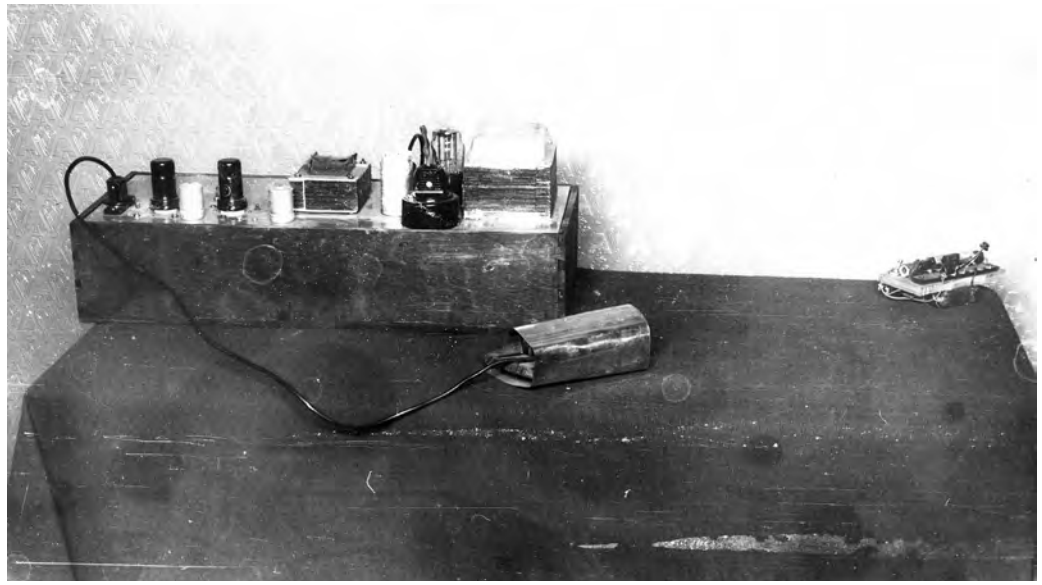
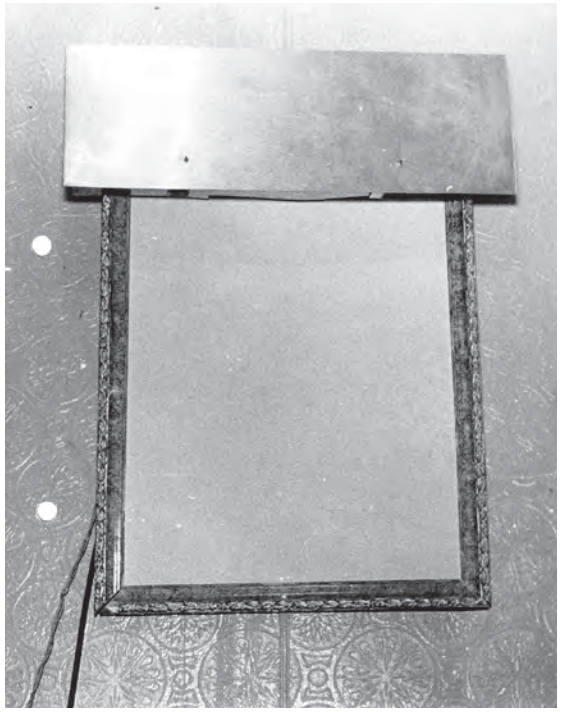


fig 2.32 Device for tracking the movement of piano pedals. TCA.

fig 2.33 The wireless transmitter and receiver. TCA.



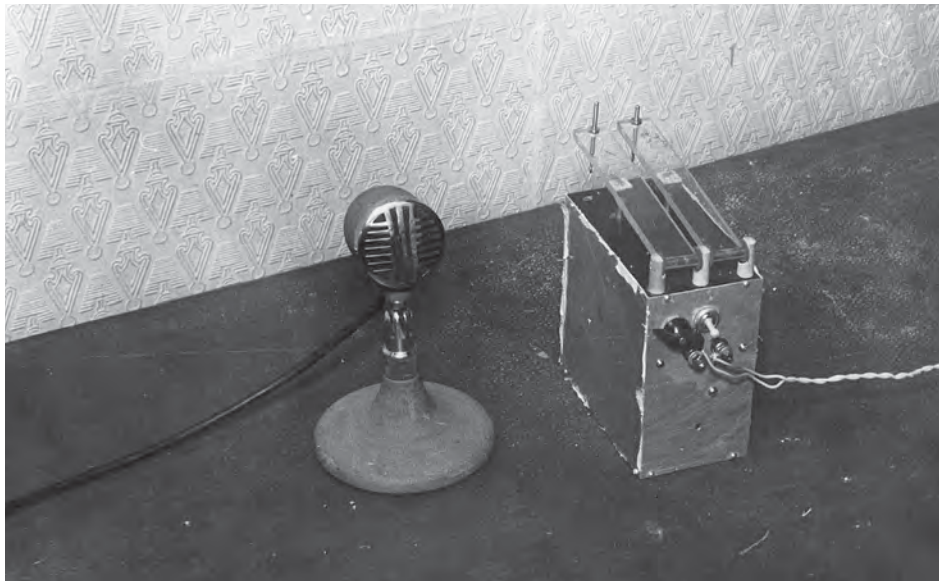


fig 2.34 Special screen for visualization of the incoming data by means of a light projection with variable colour. TCA.

fig 2.35 Test version of the sensors to be installed under the pedals of a concert grand piano with the purpose of tracking their movement synchronously with an audio recording during the musical performance. TCA.

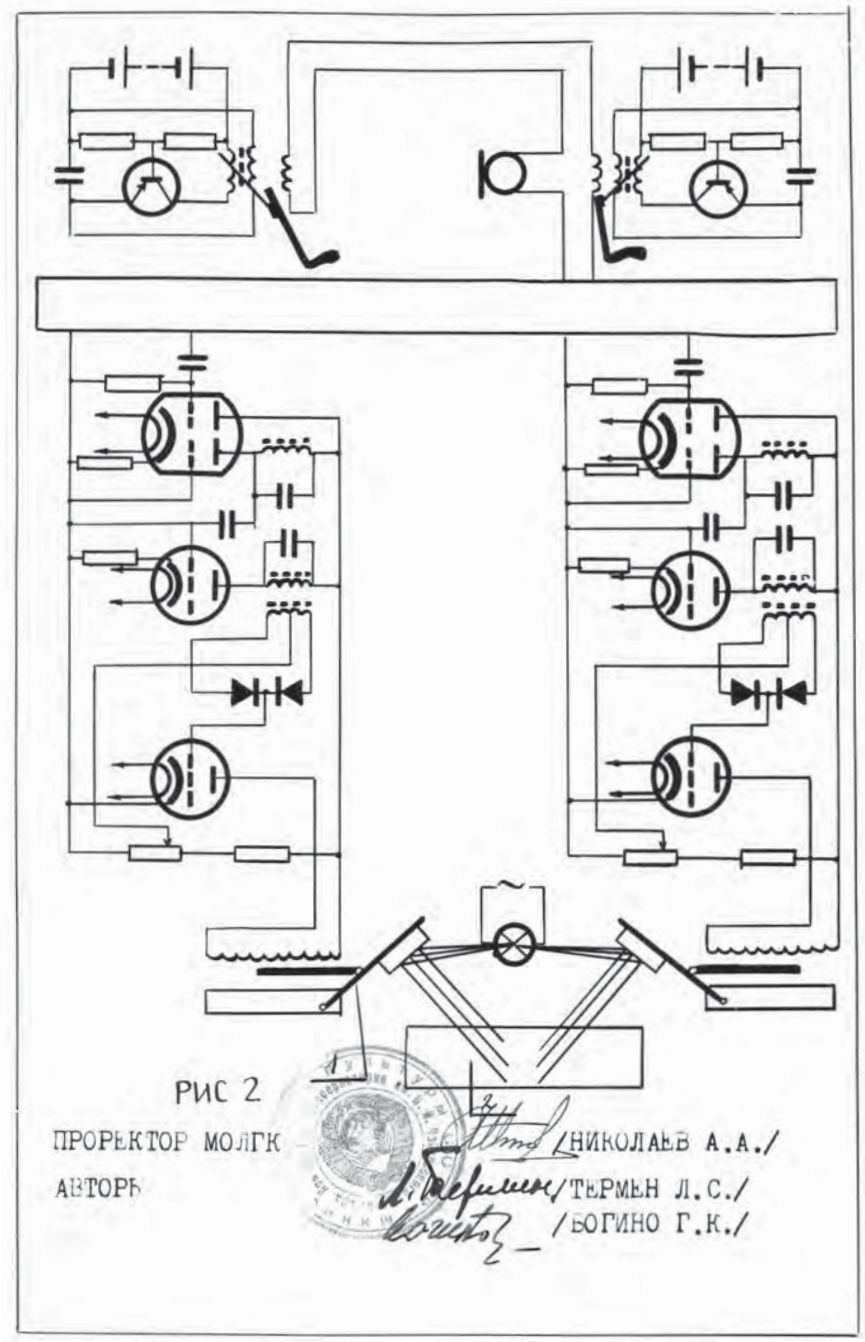


fig 2.36 Leon Theremin and Georgy Bogino. Schematic diagram of the ‘device for tracking the movement of piano pedals with its subsequent visualization’. TCA.

3. NEW TRENDS AND INSTITUTIONS

PROLETKULT

The proletarian culture movement Proletkult was founded in 1917 by economist and philosopher Alexander Bogdanov (1873–1928, born Malinovsky) often referred to as the 'father' of cybernetics. Bogdanov's grand project was *Tectology*. It was a proposal to develop a universal science of organization and analysis, through a search for structural similarities in all spheres of knowledge. He advocated the re-examination of works of art to reveal their structure and underlying premises, as a step towards the development of a new art. Alexei Gastev was considered the main ideologist of Proletkult.

In 1918 the Federation of Futurists (an organization that collaborated with Proletkult) demanded: 'Separation of Art from the State. Destruction of political control over Art. Down with diplomas, ranks, official posts and grades. Universal Artistic Education.'[1] Proletkult was also founded on the idea of independence from the State. It developed a huge network of artistic and scientific organizations. From the start it was an independent, non-governmental association that subsumed more than 200 organizations in various areas of art. Proletkult sponsored schools and workshops throughout the country that taught workers to read, write, make art, and to think about science, principally from Bogdanov's organizational point of view. Their proclaimed goal was to strive for the universal development of a 'creativity of new proletarian culture', to encourage and to focus the creative power of the proletariat in the fields of science and the arts. The plastic arts were influenced initially by Constructivism, and literature and music by Futurism.

By 1920 Proletkult comprised around 400,000 members across Soviet Russia. Avant-garde artists, writers and actors were often involved in Proletkult workshops. Proletkult participants took part in literacy and foreign language classes, as well as lectures on recent scientific achievements. They also attended classes in music, the visual arts, musical concerts, plays and readings offered by professional artists from low-, middle- and upper-class backgrounds, including Anatoly Lunacharsky, Alexei Gastev, Platon Kerzhentsev, Arseny Avraamov, Nikolai Roslavets, the symbolist writer Andrei Bely, the avant-garde painter Olga Rozanova and many others.

Proletkult's demands for autonomy put it on a collision course with the Communist Party. In December 1920, Lenin issued a devastating critique of the organization, attacking the very idea of a unique proletarian culture. Proletkult was immediately made into a subsection of the governmental cultural agency, the Commissariat of Public Enlightenment. In April 1932,

1 'Manifest letuchei federacii Futuristov' (The Manifesto of the Flying Federation of Futurists). *Gazeta Futuristov*. N1, 15 March 1918. The manifesto was signed by Vladimir Mayakovsky, Vasily Kamensky and David Burliuk. Trans. AS.

the Communist Party summarily closed down Proletkult along with all other cultural associations that assumed special ties to workers.

GINHUK — THE PHONOLOGICAL DEPARTMENT

Among the avalanche of new cultural institutions established in Russia in the early 1920s, shortly after the end of the Civil War, GINHUK — the State Institute for Art Culture — was one of the most important. In 1923 the painter and art theoretician Kazimir Malevich founded the new Research Institute of the Highest Art Knowledge as a branch of the Museum of Art Culture in Petrograd. The staff of the Institute included, among others, Malevich himself, Vladimir Tatlin, Mikhail Matyushin and Nikolai Suetin. The poet and artist Igor Terentiev was appointed head of the Phonological Department.

fig 3.1 Igor Terentiev. Self-portrait. c. 1920. 'Moi pohoroni'. Moscow, Gilea, 1993.

According to its official program: 'The Phonological Department will conduct scientific (inventive-research) work in the field of sound, analyzing its material structure with the purpose of the best technical-industrial application of art. Sound is to be subjected to research in a pure form, i.e. as a physical phenomenon, and also in the form of speech and music. The approach of the Phonological Department is based on scientific-experimental and statistical methods — the methods of analogy in its expanded and advanced forms, i.e. *the methods of invention*...' [2]

The main field of work of the Phonological Department was language, especially the 'possibilities of sound applications in the process of creation of an international language'.[3] Among the other subjects of research were: new music and non-figurative art; the connections between contemporary music and contemporary language; the importance of 'recondite language'; the analysis of intonational relationships; and the interaction of languages, whether scientific, philosophical, religious, bureaucratic, infantile or poetic and so forth.

2 Terentiev, I. The Program of research at the Phonological Department, Petrograd, 1923. Quoted in *Terentievsky sbornik* (Terentiev's Collection), Moscow, Gilea, 1996, p.115. Trans. AS

3 *Ibid*.

The Phonological Department offered a strong basis for the development of new poetic forms, especially visual poetry and sound poetry — the basis of subsequent text-sound composition. In spite of the fact that there were no acousticians or musical theorists involved, the Phonological Department proclaimed objective scientific approaches:

We should knock the psycho-aesthetical wedge out of art. Art activities should not be limited by any conditional laws of pure logical consciousness, individual psychological associations, special cases of personal experience or other human feelings... It is necessary to update attitudes to sound. It can be done only in concrete live work with noises. Work should be conducted taking into account the following three properties of a sound:

(a) Duration. The sound lasts in time...

(b) Pitch. Everything that sounds is intoning at a certain pitch... It is not really applicable to noises. It is necessary to establish their relative pitches. As a criterion of the attitude it is possible to take the intonation of a human voice.

(c) The tone colour, i.e. the timbre of sound – its static characteristic in each certain case. It is necessary to define the sources of similarity and difference...

1) Distinction of sounds on a material and the form of the sounding object.

2) Distinction of sounds on the sound material itself.[4]

In 1925 Terentiev developed the basic part of a thesis concerning 'drama art' in the article entitled 'Amateur Theatre', which in many aspects is reminiscent of Futurist theory as well as of the theories of Meyerhold, with whom he wished to collaborate at this time. Similar to the theories of Sergei Eisenstein, at the heart of his consideration was the concept of 'montage', which had to become an organizing principle to subordinate all other aspects: [5]

Not music – but sound-montage! Not scenery – but mounting! Not the play – but literature-montage!... We don't need a theatrical naturalism! Theatre can be strong by means of the organization of sound material: a voice, an instrument, a sound-editing tool... It is necessary to build a theatre on the basis of sound – slightly supplementing it with visible material – and on movement, as movement – as a reflex on a sound.[6]

4 Druskin, Y. 'The Sounding Substance'. Petrograd, 1923. Quoted in *Terentievsky sbornik* (Terentiev's Collection), Moscow, Gilea, 1996, p.121. Trans. AS.

5 Jaccard, J-P. *Daniil Harms et la fin de l'avant-garde russe*, Berne, Peter Lang, 1991.

6 Terentiev, I. 'The Amateur Theatre'. The collected works, Bologna: S.Francesco, 1988, pp.297-299.

Each play was to be represented as a 'living book' which the writer defines as: 'Literature-montage + sound + Bio-montage'[7]. This last concept concerns the actor and, undoubtedly, goes back to the biomechanics of Alexei Gastev, Nikolai Bernstein and Vsevolod Meyerhold.

In 1926 GINHUK was closed together with all branches and departments, including the Phonological Department.

GIMN — THE STATE INSTITUTE FOR MUSICAL SCIENCE

GIMN was founded in Moscow in spring 1921 in an attempt to centralize all activities related to musical science including disciplines such as acoustics, musicology, psychology, physiology, the construction of new musical instruments, and ethnomusicology. Nikolai Garbuzov was elected Director.

fig 3.2 Nikolai Garbuzov. c. 1930. TCA.

The first building for GIMN was arranged by Boris Krasin — a managing director of Muzo (the Department of Musical Education of the Commissariat of Public Enlightenment). It was a former private residence of A.K. Ushakov on Prechistenka street. After a few months, due to the lack of available apartments in Moscow, the Commissar of Public Enlightenment, Anatoly Lunacharsky passed the building to the American dancer Isadora Duncan after her arrival in Russia in July 1921 and GIMN was moved to another building on Bolshaya Dmitrovka 7 (a few blocks from Gastev's CIT Institute).

From the beginning GIMN was oriented towards academic research. Among GIMN associates were many scholars and inventors from the realm of music and beyond, including Piotr Zimin, who specialized in the research

7 *Ibid*. p.299.

of musical instruments, especially organs and pianos. He did very advanced research into rhythm and temporal characteristics of instrumental musical performance, which was similar to the research concurrently taking place in Leningrad, conducted by Evgeny Sholpo. Leonid Sabaneev[8] undertook research into Alexander Scriabin's music, microtonal ultra-chromatic music, synaesthesia and 'colour hearing'. Pavel Leiberg was exploring microtonal scales, combinational tones and beats, while Alexander Samoilov, supposing that the structure of a spatial lattice of musical intervals possesses the same features as the structure of a spatial lattice of crystals, conducted research into the nature of sonic space, studying the relations of musical intervals in linear, two-dimensional and three-dimensional harmony spaces.

Among the many researchers and inventors involved were Leon Theremin, Nikolai Bernstein, Boris Krasin, Emily Rosenov, Mikhail Gnesin, and Arseny Avraamov. Numerous research projects were conducted, articles published and experimental devices built, including a harmonium in natural (overtone) scale, and a quarter-tone harmonium with two keyboards. Sergei Rzhevkin built his radio-harmonium on cathodic valves, which was the second electronic musical instrument to have been built in Russia after the invention of the Theremin. It was a sort of three-voice oscillator, capable of producing polyphonic chords in any temperament.[9] Nikolai Garbuzov built a device to study the phenomenon of synopsia (colour hearing).
In 1923 GIMN was equipped with a radio-station, developed by I. Homutov, to broadcast music and related discussion. In 1923 GIMN supported the performance of Avraamov's *Symphony of Sirens* in Moscow and even applied for an additional night-time show, which was never realized.

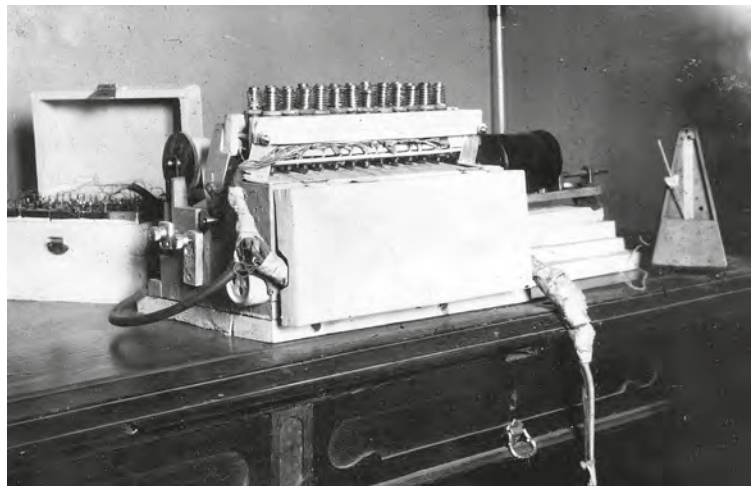
In autumn 1923 Avraamov was involved in the reorganization of GIMN. He considered this institution his own creation since most of its research activities were based on the ideas he had developed and published in numerous articles between 1914 and 1916. It came to represent a struggle between revolutionary artistic approaches and the increasingly conservative mentality. Although the draft program of the new GIMN was signed by Avraamov and Garbuzov, the final document contained neither Avraamov's ideas nor his signature. Even though Mikhail Gnesin — one of Russia's foremost composers — considered Avraamov one of the founders of Russian musical acoustics,[10] in the official documentation of GIMN Avraamov's name is not even mentioned.

In 1931 GIMN was closed and in 1933 it was revived at Moscow State Conservatory where it was renamed NIMI (the Russian abbreviation of the Scientific Research Musical Institute) and then again, in the late 1930s, as the Acoustical Laboratory. In 1990-91 it was on the verge of closing but in 1992

8 Leonid Sabaneev (1881–1968) was a Russian musicologist, music critic, composer and scientist. He graduated in mathematics and physics from Moscow University in 1908. His musical studies were under Nikolai Rimsky-Korsakov, Sergei Taneyev, Nikolai Zverev and Paul de Schlözer at the Moscow Conservatory. He was also responsible for several science projects on mathematics and zoology. Sabaneev left Russia and emigrated to Paris in 1926.

9 Orlov, I.E. 'Opiti s katodnim harmoniumon Rzhevkina' (Experiences with the Rzhevkin Cathodic Harmonium). *A collection of works on musical acoustics*. 1st edition. Works of the State Institute for Musical Science. Musical sector of the State publishing house. Moscow, 1925, p.21.

10 Gnesin, M. Arseny Avraamov's testimonial. Manuscript. Moscow, 1940. Oleg Komissarov's private archive.



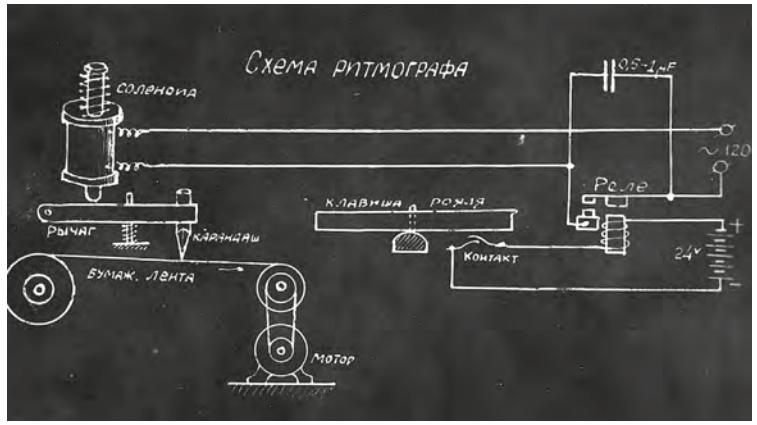
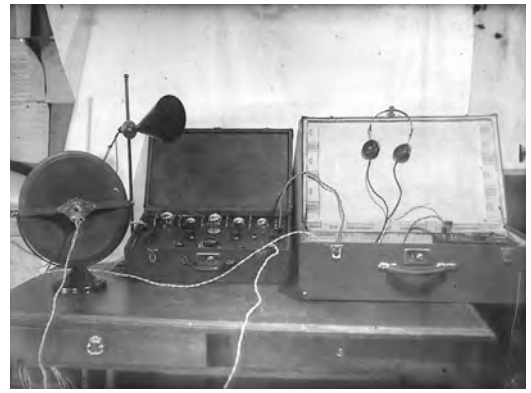
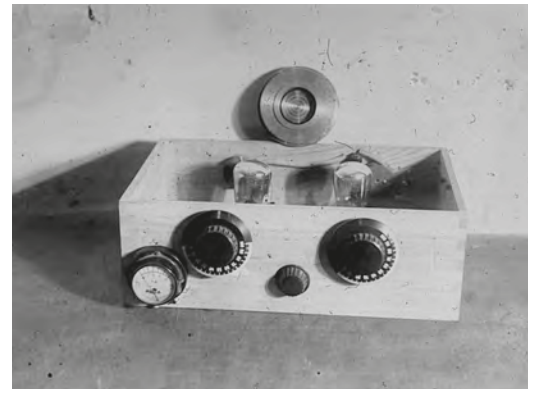


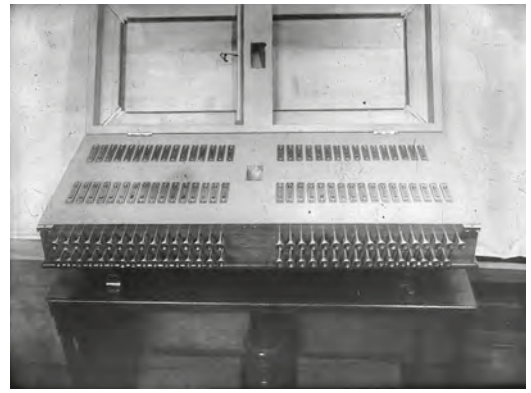
fig 3.3 Meeting of the GIMN Board, 1925. Nikolai Garbuzov (in the centre). From the book *Five years of GIMN scientific activity 1921-26*, Moscow, 1926. TCA.

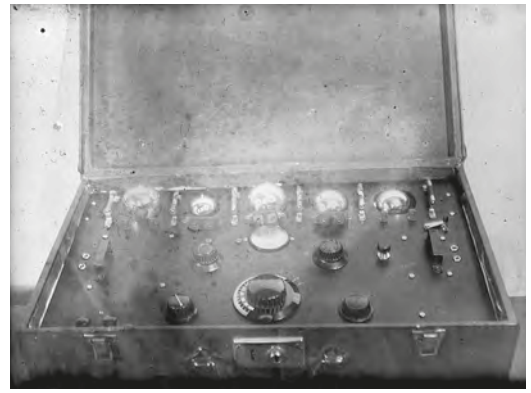
fig 3.4 Rhythmograph by Piotr Zimin. Device intended for research into rhythm and the temporal characteristics of musical performance of the piano. c. 1920. TCA.

fig 3.5 A diagram of the Rhythmograph by Piotr Zimin. c. 1920. TCA.









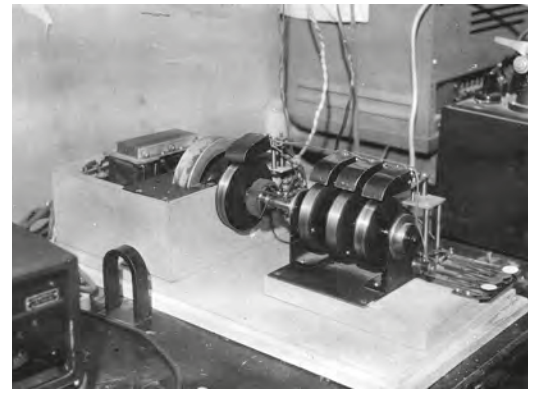


fig 3.6 (top left) GIMN radiostation. 1920s. GIMN archive. TCA.

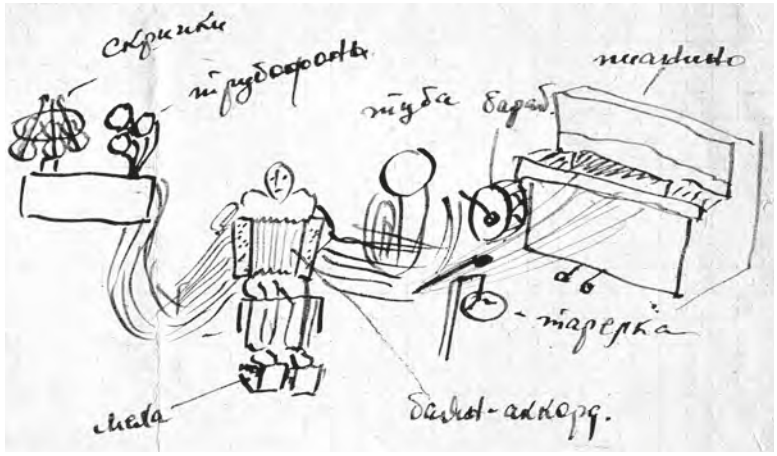
fig 3.7 (top right) One of the devices from GIMN. 1920s. GIMN archive. TCA.

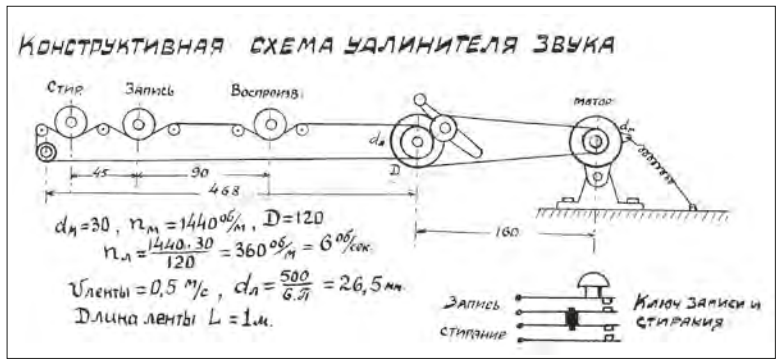
fig 3.8 (mid left) Acoustical microtonal instrument, GIMN studio. 1920s. GIMN archive. TCA.

fig 3.9 (mid right) Experimental device for magnetic audio recording on steel wire. GIMN. 1920s. TCA.

fig 3.10 (bottom left) Radio transmitter from the GIMN studio. 1925. GIMN archive. TCA.

fig 3.11 (bottom right) One part of the device for time stretching and spectral analysis. NIMI. 1930s. TCA.





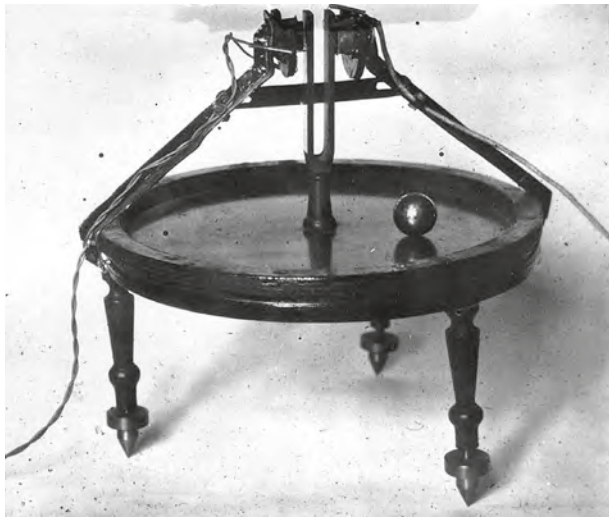


fig 3.12 Alexander Sovetov's illustration from his proposal for the 'Single Person-Orchestra'. c. 1935. TCA.

fig 3.13 A diagram of the device for time stretching and spectral analysis of phonograms, magnetically recorded on steel wire. NIMI.

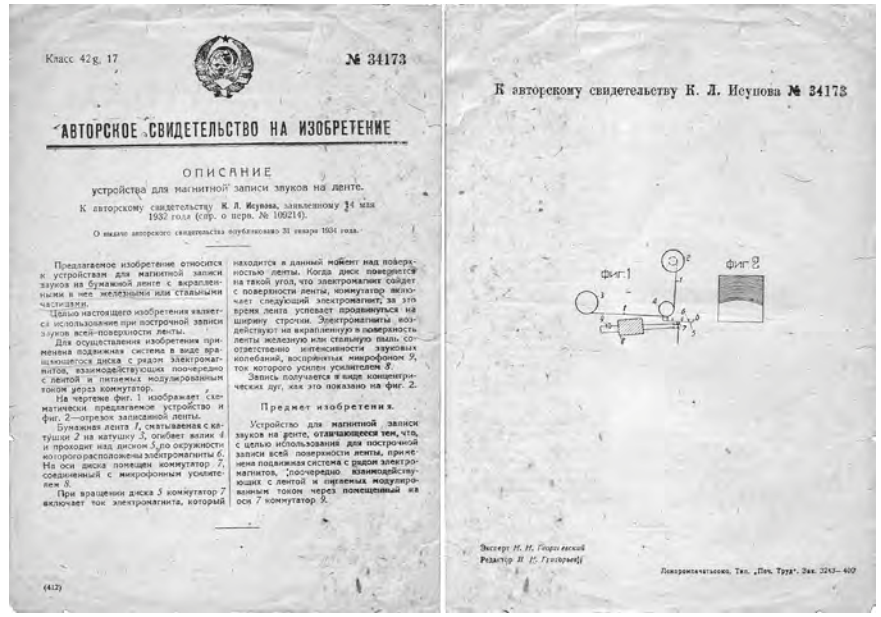
fig 3.14 'Untertone Productor' — experimental device for exploration of overtones and sub-harmonics as well as vibration modes of the deck. NIMI. 1930s. TCA.

was reborn as two departments — the Laboratory for Sound Recording and the Theremin Centre for Electroacoustic Music.

In the field of music and its technology NIMI was the highest-level organization in Moscow. Projects from all over Soviet Russia seeking a patent or financial support had to get a positive review from the appropriate NIMI experts. The explosion of creativity in the 1920s resulted in an avalanche of inventions, produced in the early 1930s all over Soviet Russia. Dozens of proposals, related to new musical instruments, new systems of harmony, new scales and temperaments, new musical 'interfaces', keyboards and fingerboards and so on are collected in the GIMN/NIMI archive.

For instance the famous futurist composer and artist Mikhail Matyushin proposed the project of the 'straight violin', to enable simpler construction than traditional violins in order to facilitate mass production as a way of addressing the shortage of musical instruments. The amateur inventor Alexander Sovetov from the village of Bolshaya Ugrezhskaya proposed the project of the 'Single Person-Orchestra' based on a special electrified accordion capable of controlling and playing the whole set of instruments in a small orchestra by a single person.■ The amateur musician Grigory Rakov from the village of Budeny (in the south of Russia) proposed the Gilzotone project — a new musical instrument based on multiple used military cartridge cases.

fig 3.12


Класс 42g, 17 № 34173

АВТОРСКОЕ СВИДЕТЕЛЬСТВО НА ИЗОБРЕТЕНИЕ

ОПИСАНИЕ

устройства для магнитной записи звуков на ленте.

К авторскому свидетельству К. Л. Исупова, заявленному 4 мая 1932 года (спр. о перв. № 109214).

О выдаче авторского свидетельства опубликовано 31 января 1934 года.

Предлагаемое изобретение относится к устройствам для магнитной записи звуков на бумажной ленте с вкрапленными в нее железными или стальными частицами.

Целью настоящего изобретения является использование при построчной записи звуков всей поверхности ленты.

Для осуществления изобретения применена подвижная система в виде вращающегося диска с рядом электромагнитов, взаимодействующих поочередно с лентой и питаемых модулированным током через коммутатор.

На чертеже фиг. 1 изображает схематически предлагаемое устройство и фиг. 2—отрезок записанной ленты.

Бумажная лента 1, сматываемая с катушки 2 на катушку 3, огибает валик 4 и проходит над диском 5, по окружности которого расположены электромагниты 6. На оси диска помещен коммутатор 7, соединенный с микрофонным усилителем 8.

При вращении диска 5 коммутатор 7 включает ток электромагнита, который находится в данный момент над поверхностью ленты. Когда диск повернется на такой угол, что электромагнит сойдет с поверхности ленты, коммутатор выключает следующий электромагнит, за это время лента успевает продвинуться на ширину строчки. Электромагниты воздействуют на вкрапленную в поверхность ленты железную или стальную пыль соответственно интенсивности звуковых колебаний, воспринятых микрофоном 9, ток которого усилен усилителем 8.

Запись получается в виде концентрических дуг, как это показано на фиг. 2.

Предмет изобретения.

Устройство для магнитной записи звуков на ленте, отличающееся тем, что, с целью использования для построчной записи всей поверхности ленты, применена подвижная система с рядом электромагнитов, поочередно взаимодействующих с лентой и питаемых модулированным током через помещенный на оси 7 коммутатор 9.

(412)

К авторскому свидетельству К. Л. Исупова № 34173

фиг 1 фиг 2

Эксперт И. И. Гецович
Редактор И. Р. Гуторович

Ленпромпечатьсоюз. Тип. „Печ. Труд". Зак. 3243—407

fig 3.15 The Instrument for the Magnetic Recording of Sound on Tape proposed by inventor K. L. Isupov, based on a system of rotating magnetic heads. USSR Copyright Certificate No. 34 173, filed 4 May 1932.

Some proposals were surprisingly advanced, like the 'Instrument for the Magnetic Recording of Sound on Tape' proposed by inventor K. L. Isupov.[11] It was a method of magnetic sound recording based on a system of

11 USSR Copyright Certificate No. 34 173, filed 4 May 1932.

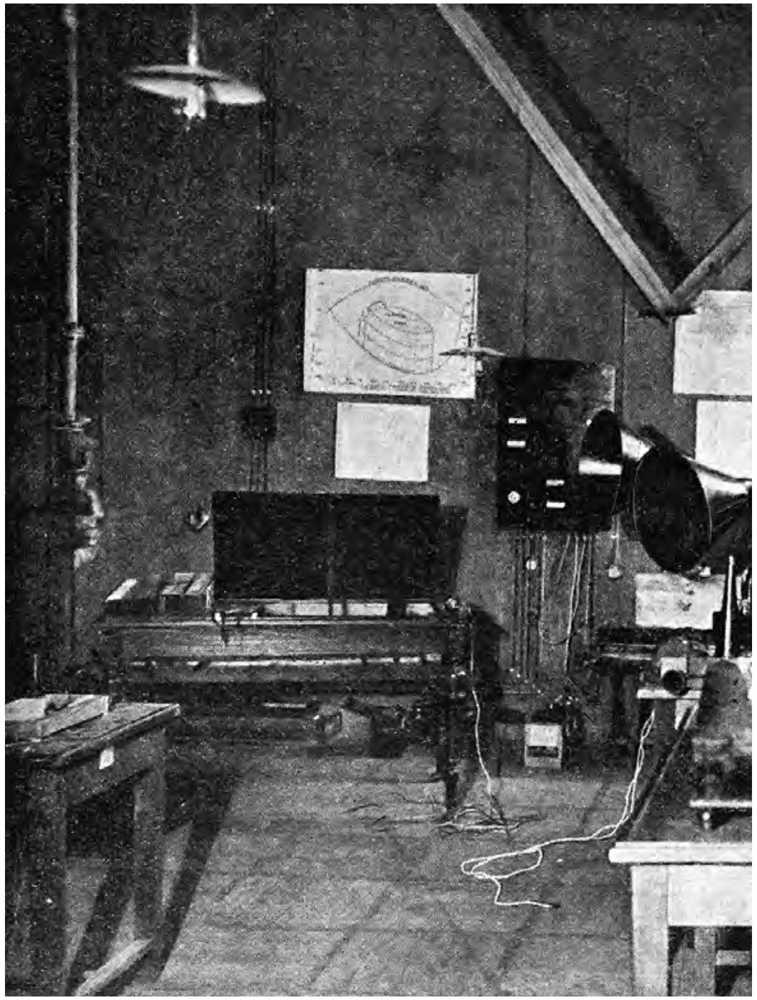
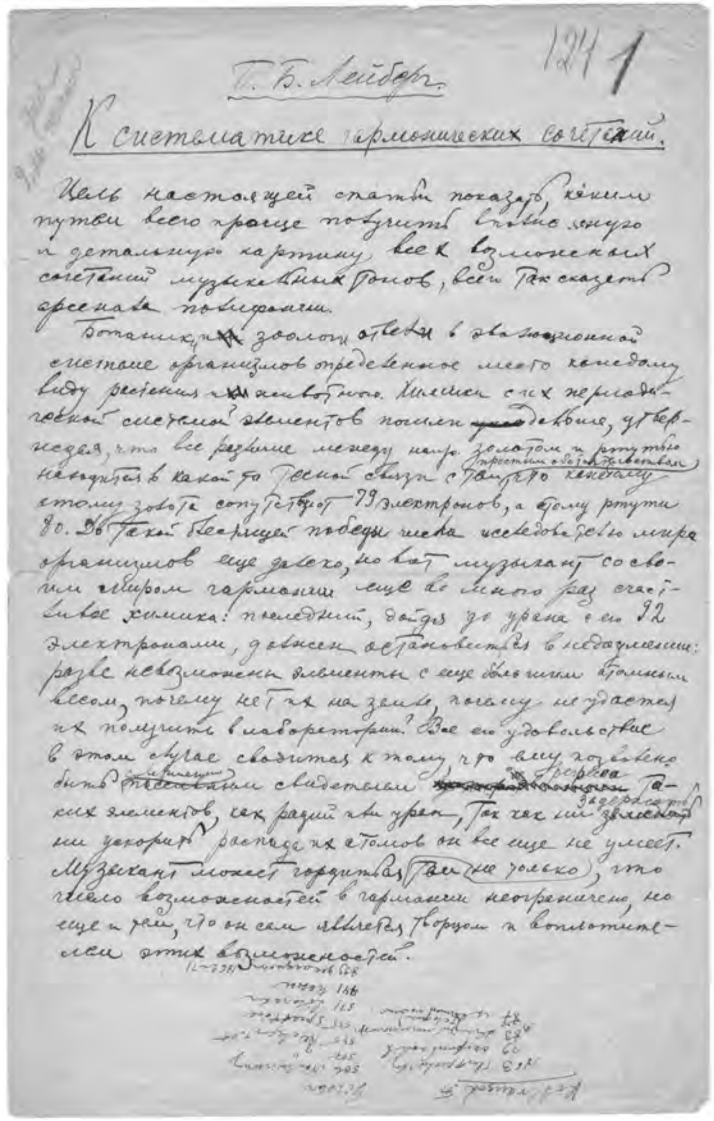


fig 3.16 GIMN Studio, Moscow, 1920s. From the book *Five years of GIMN scientific activity 1921-26*, Moscow, 1926. TCA.

fig 3.17 Device for automatic piano performance. A type of Pianola. GIMN. c. 1925. TCA.

rotating magnetic heads, which was very similar to the technology that was being developed in Germany around the same time and which led to late twentieth century video recorders.

As many of the experts were undertaking similar research or had different aesthetic views, their responses were often negative, based on biased opinions and self-interest rather than scholarship, discourse and the greater good. In the GIMN/NIMI archive a number of surprising stories can be found that illustrate the complicated and often dysfunctional process of interaction between the authoritarian State and the creative community. According to NIMI correspondence, by the late 1930s this great wave of ideas and innovation had almost finished and never came back again.



П. Б. Лейберг

К систематике гармонических сочетаний

fig 3.18 One page from Pavel Leiberg's manuscript 'Towards the systematization of harmonious combinations'. GIMN. 1923. TCA.

MICROTONAL MUSIC

One of the most popular areas of experimentation and research in the first decades of the 20th century was microtonal music. It was stimulated in 1907-09 independently by Ferruccio Busoni in Europe and Nikolai Kulbin in Russia. But the first practical and theoretical work in Russia was published in numerous articles by Arseny Avraamov in 1914-16. In a series of articles, published by the leading Russian musical magazines, such as *Muzikalni Sovremennik* (The Music Contemporary) and the almanac *Muzika*, he developed the theory of microtonal 'Ultrachromatic' music and invented special instruments to perform it. Shortly after the October Revolution he proposed to the Commissar of Public Enlightenment, Anatoly Lunacharsky, a project to burn all pianos — symbols of the despised twelve-tone, octave-based 'well-tempered' scale, which he believed had adversely affected human hearing for several hundred years.

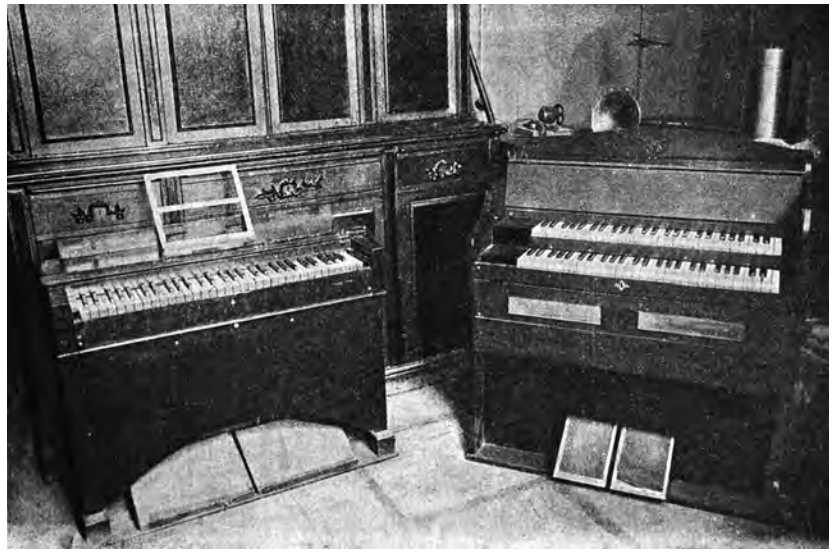


fig 3.19 Harmoniums in natural and microtonal tuning at GIMN studio. c. 1923. Arseny Avraamov used these instruments in his lectures in 1923-24. TCA.

By the 1920s there were many musicians involved in this research and related composition. Among them were Leonid Sabaneev, Arthur Lourie, Emily Rosenov, and Piotr Renchitsky. One of the most advanced studies on microtonal music was developed by polymath Pavel Leiberg — a teacher of mathematics and physics at Moscow University as of the 1890s. Being very much involved in musical acoustics, he undertook substantial research on acoustical resonances and from 1923, working at GIMN, he developed a series of studies on microtonal music, which he presented in a series of reports ■ (see figs **3.18** and **3.20-21**). He compared various microtonal scales as well as exploring the physical nature of microtonal scales and related phenomena of human perception, and proposed the construction of a harmonium in the forty-one-tone temperament.

figs →

Other microtonal music projects under development included those of Leonid Sabaneev, who developed a mobile instrument based on a twenty-eight-tone 'modulation scale' as well as a fifty-three-tone well-tempered

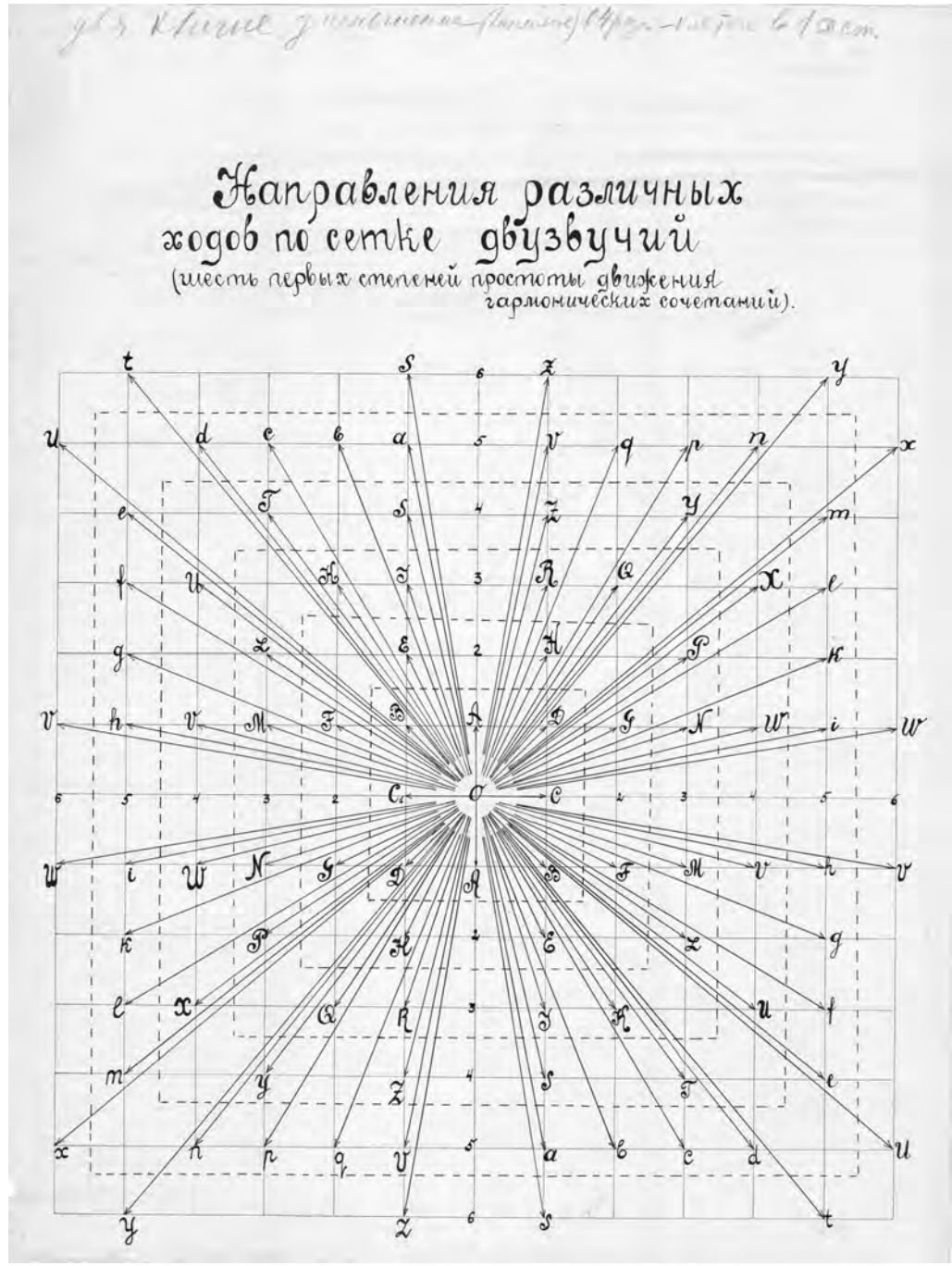


fig 3.20 Microtonal diagrams by Pavel Leiberg. Harmony diagram of microtonal duads. GIMN. 1923-27. TCA

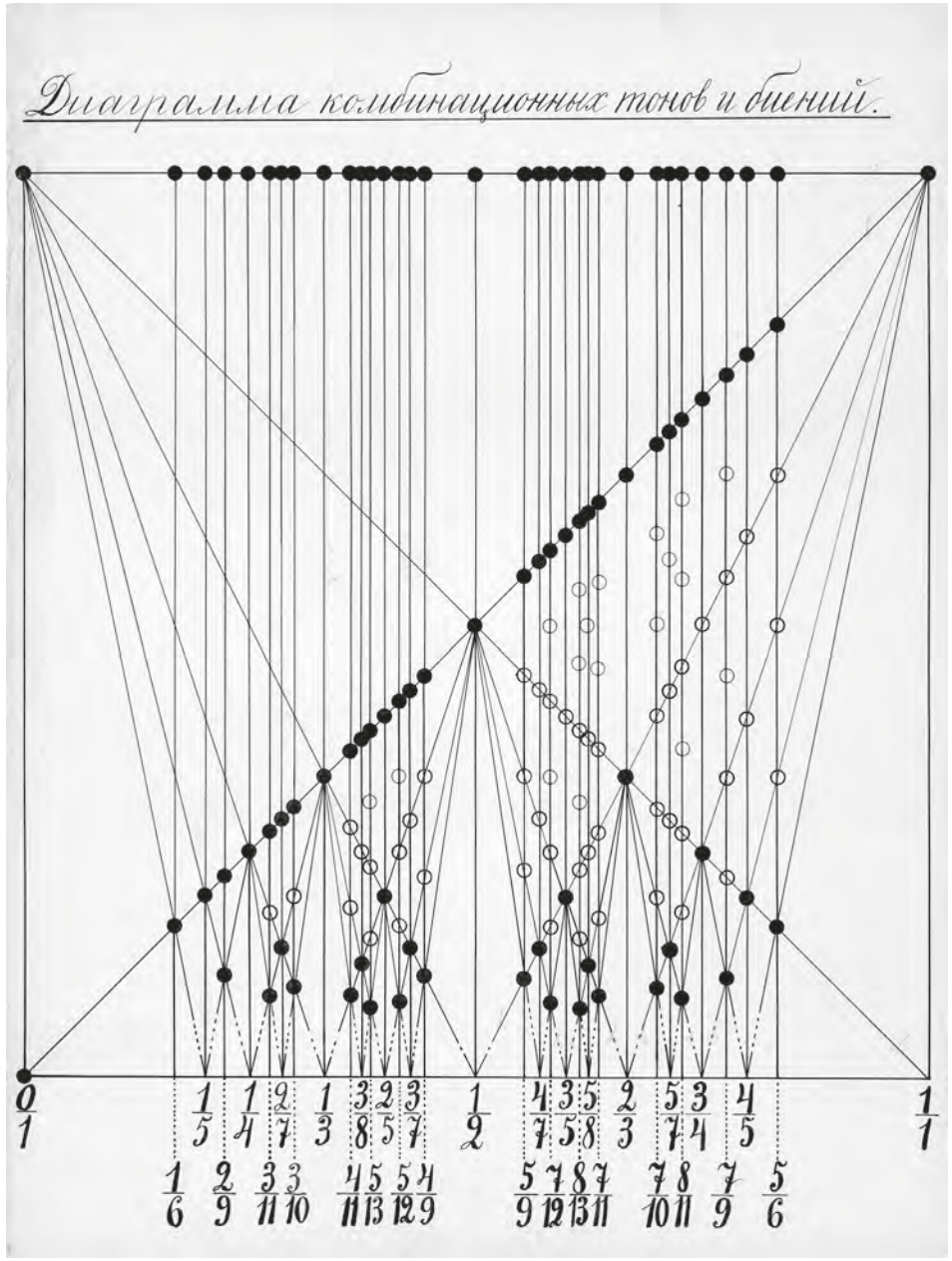
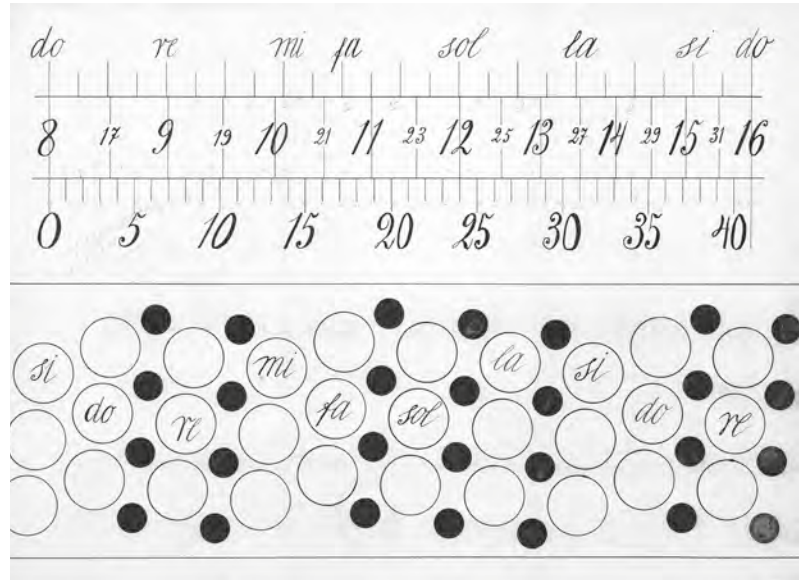


fig 3.21 Microtonal diagrams by Pavel Leiberg. 'Diagram of combinational tones and beats'. GIMN. 1926. TCA.



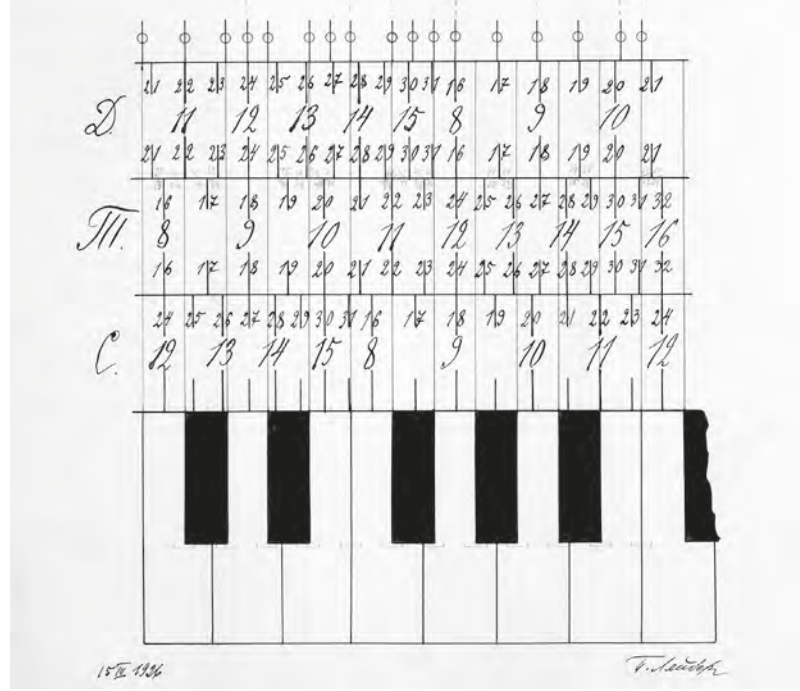


fig 3.22 Example of forty-one-tone scale with a project for a related keyboard. GIMN. 1920s. TCA

fig 3.23 Comparison of various scales. GIMN. 1926. TCA.

scale and related harmonium with four musical keyboards. Emily Rozenov conducted research into the analysis of temperaments from twelve up to forty-eight steps based on Rimsky-Korsakov's methods. He proposed the construction of a harmonium based on a seventeen-tone 'overtone-undertone modulation scale' (permitting transpositions between different tonalities), possessing three keyboards and special controls for transposition. Piotr Renchitsky was at work developing a twenty-four-tone well-tempered system as a way of extending the common temperament. Avraamov made several studies on the 'De-temperament of Music', Ultrachromatism and the Universal Tone System (the Welttonsystem).

NEW ELECTRONIC MUSICAL INSTRUMENTS

In 1923 at the acoustical laboratory of GIMN one of the leading Russian acousticians Sergei Rzhevkin developed his Cathodic Harmonium — the next experimental electronic musical instrument developed in Russia after the Theremin. It incorporated special oscillators, based on the principle of beats, realized by means of three-electrode 'cathodic' lamps and three independent coils. The device could produce three long tones simultaneously with a simple timbre, which could be changed at will. It was extremely convenient for acoustic experiments. The pitch of tones could be precisely tuned and controlled by a special musical keyboard permitting adjustment of any pitch ratios of tones.[12]

fig 3.24 Sonar. NIMI. c. 1933. TCA.

In 1926 Nikolai Ananiev built his Sonar — a monophonic instrument considered to be an improvement of the Theremin, based on a horizontal fingerboard, made with a long narrow coil covered with an elastic conductive strip, stretched out along the fingerboard, permitting the performer to vary the pitch of the audio oscillator by means of pressing the strip at appropriate points. The volume could be controlled by means of a special foot pedal. This approach became quite popular — as of the late 1920s many inventors all over Russia developed electronic musical instruments based on this technology. In the later versions the instrument had a timbre control by means of which the timbre of violin and even simple voice could be imitated. In the 1930s at Saratov Conservatory a special course for Sonar performers was established. During his life Ananiev gave over 600 concerts which were attended by almost 500,000 people. In the late 1930s during a concert at Moscow Conservatory Ananiev called out some well-known violinist from the audience to compete with him. Both performers played the same piece one after another. According to the reaction of the audience, the Sonar won.[13]

Perhaps the most important instrument was the Ekvodin, developed at NIMI in the early 1930s by Theremin virtuoso Konstantin Kovalsky and young inventor Andrei Volodin. It was a long-term and highly successful research project. While originally it was operated from a single fingerboard in the first version, in the second version (V-2) there were two fingerboards — one with continuous pitch control and the second with a chromatic scale. In the early 1950s it was replaced with a conventional keyboard, as in the V-8 model, which appears to have had a fingerboard in addition to two manuals of about forty-five notes, along with improved attack and a greater range of timbres. The Ekvodin version V-9 was awarded gold medals at the 1958 World Fair in Brussels (EXPO 58) and at the 1959 Exhibition of National Economy Achievements in Moscow.

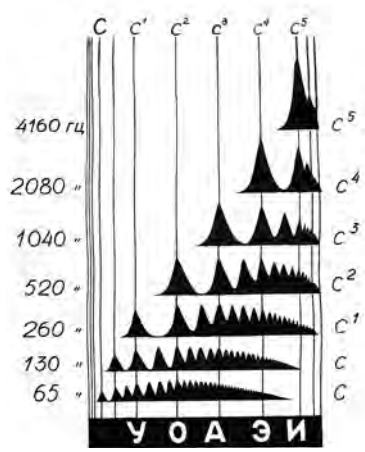


fig 3.25 Andrei Volodin's illustration of vocal formants. During the development of the Ekvodin, Volodin conducted extensive research related to the resonant properties of various acoustical sound sources and the methods of related sound synthesis. TCA.

The V-11 (early 1960s) has a single manual of about forty-one notes (transposable within a compass of over seven octaves). It was one of the first analogue electronic musical synthesizers, and came replete with a dynamical, velocity-sensitive keyboard with a feature of aftertouch (pressure sensitivity), the option of playing vibrato on the keyboard with

12 Orlov, I.E. 'Experiences with the Rzhevkin cathodic Harmonium'. *A collection of works on musical acoustics*. 1st edition. Works of the State Institute for Musical Science. Musical sector of the State publishing house. Moscow, 1925, p.21.

13 Anfilov, G. *Fizika I muzika*. Detgiz, Moscow, 1962, pp.106-107.

one's fingers as on the violin, two voices, 660 presets with excellent imitations of all the acoustical musical instruments of a symphony orchestra including percussion, glide (portamento) control, built-in fingerboard, volume-control foot pedals, special levers for knee control of the timbre, and synthesis, based on its maker's research into musical acoustics and psychoacoustics.[14]

Another important development was the Violena — a fingerboard instrument permitting virtuoso musical performance comparable with classical string instruments. The instrument was developed by Vladimir Gurov in the early 1930s and could be compared with early versions of the famous Trautonium, which was built in Germany by Friedrich Trautwein in 1929.

In 1936 Igor Simonov developed his first monophonic electronic musical instrument, and in 1937 he built the Companola — a polyphonic electronic keyboard musical instrument.

fig 3.26 Emiriton. c. 1940. Courtesy of Rodion Chistiakov.

The Emiriton was one of the first electronic musical instruments built in Leningrad in 1935 by Andrei Rimsky-Korsakov and Alexander Ivanov with assistance from Viktor Kreitser and V.P. Dzerzhkovitch. More advanced versions of the Emiriton were manufactured in the 1940s. Owing to a combination of the keyboard and a fingerboard, the Emiriton gave the opportunity to play music based purely on intonation as well as the well-tempered scale. It was possible to change the timbre instantly, and the foot pedal afforded very precise control of volume.

Although most of the early electronic musical instruments built in Russia had means with which to perform microtonal music, they were never used for any avant-garde, experimental projects. All institutionally based developments initiated in the 1930s had to fit within the boundaries of the official ideology and politically correct aesthetics.

14 Volodin, A. 'Elektro-muzikalnii instrumenti' (Electro-musical Instruments), *Muzika*, Moscow, 1979, pp.69-71 .

fig 3.27 Ekvodin V-9. c. 1960. TCA.

fig 3.28 Inventor Andrei Volodin playing the Ekvodin. c. 1960. TCA.

fig 3.29 Alexander Ivanov and Dmitry Shostakovich playing on the Emiriton. c. 1939. TCA.

CIT — THE CENTRAL INSTITUTE OF LABOUR

CIT (also known as the Institute for the Scientific Organization of Work and the Mechanization of Man, or TsIT (Tsentral'nyi Institut Truda) in Russian transliteration) was founded by Alexei Gastev in Moscow in 1920 and supported by Lenin. The physiological research at CIT was based on conceptual approaches and experimental methods in the science of biomechanics. It was scientific research with an interdisciplinary and broad-ranging agenda.

CIT was an unusual institution that was frequented by fanatical veteran inventors and fascinated youth alike. Alongside the physiological laboratory there were the labs for 'sensorics', 'psychotechnics' and education. A variety of 'multimedia' tools and 'interactive' gadgets were devised including instruments for photography and film, systems for monitoring musical performances and instructorless simulation apparatus for cars and planes.

Gastev investigated the functions of certain 'operational complexes' that encompass both worker and machine in a single unbroken chain: 'These machine-human complexes also produce the synthesis between biology and engineering that we are constantly cultivating. And the integrated, calculated incorporation of determinate human masses into a system of mechanisms will be nothing other than social engineering.'[15] By 1926 Gastev had put forward the idea of training automata. He declared:

We start from the most primitive, the most elementary movements and produce the machine-ization of man himself... The perfect mastery of a given movement implies the maximum degree of automaticity. If this maximum increases... nervous energy would be freed for new initiating stimuli, and the power of an individual would grow indefinitely.[16]

According to the CIT methodology every physical motion of cadets was precisely planned and assessed so that by the end of training, full automatism could be achieved. The human body was to become a machine. The elaborate and functionally differentiated composition of the modern factory suggested to him a gigantic laboratory in which new patterns of human interactivity and cultural value come into being. Because of its emphasis on the cognitive components of labour, some scholars consider Gastev's approach to represent a Marxian variant of cybernetics. As with the concept of 'Organoprojection' (1919) by Pavel Florensky,[17] underlying Bernstein and Gastev's approach lay a powerful man-machine metaphor.

In 1928 Gastev organized the Ustanovka ('Setup') joint-stock company which audited the work of industrial enterprises and provided recommendations on efficient organization of their work processes on a commercial basis, which led to the complete financial independence of CIT from the State. By 1938 CIT had produced over 500,000 qualified workers in 200 professions and 20,000 industrial trainers in 1,700 educational centres.

15 Gastev, A, 'Organicheskoe vnedrenie v predpriiatie' (Organic Penetration into the Enterprise), in *Kak nado rabotat* (How One Should Work), p.223. Trans. AS.

16 Quoted in *Slava Gerovitch.* 'Love-Hate for Man-Machine Metaphors in Soviet Physiology: From Pavlov to "Physiological Cybernetics"', *Science in Context.* Vol. 15, 2002, p.344.

17 Executed by NKVD in the late 1930s.

In a semicircular red brick building there is a sacred dwelling of the pontiff of the Machine God. It is A. Gastev's Institute for the Scientific Organization of Work and the Mechanization of Man, distinguished by the most complicated measurements and calculations by fashionable bio-mechanical astrologers of all divine essence and expediency of their idol.

On entering the building, you find a number of investigators engaged in fixing the general maximum output capacity of the human organism. Four departments and seven laboratories are conducting research in defining the neo-alchemical origins of the human-machine. In a psychological-technical laboratory, other people are trying to ascertain how much energy is used in every movement, and how this movement can be made in the most economical way. The 'balance of energy' is fixed as exactly as possible, and efforts are made carefully to ascertain the optimum periods both of work and rest.

Gastev has discovered the basic law of movement: all movements, in his theory, may be traced back to two archetypes, an 'impact' and a 'pressing'. On the basis of these two archetypes, a careful analysis is made of all complicated combined processes of work and an investigation of the most rational methods of carrying them out. Anyone entering the front door of this institute as a normal living man, issues from the back door, after passing through countless laboratories, as a completely perfected working machine. But, if so desired, 'directive apparatus', 'administrative machinery', or 'management regulators' can also be produced as well as 'labour machines'. Their practicability is proved, or at least Gastev maintains it is, by the success attained in the use of these appliances, which are unfortunately still animate. Once all superfluous movements have been eliminated, you finally do away with all waste of energy and arrive at a higher output with less expenditure of energy.

And, thus, it is possible to reach at a lower expenditure of power the highest quality of productivity. Gastev's institute has established also that this principle of organization could be extended to all physiological elements, and thus a 'rhythmic rotation of work' is produced, which not only completely gets rid of all disturbing caprices and eccentricities of the nerves and the soul, but also removes all constitutional mental obstacles.

The machine man is produced and guaranteed to function properly. Gastev himself is certainly the one who struggled the most with this new idol. For years he had been sitting on a fashionable Mount Sinai fighting with his Machine God, and at last, he exhorted its recognition in its desires and all its precepts. Gastev – one of the most talented poets and thinkers of Russia, now, the first prophet of the machine. For the first time he has received revelation of ten precepts of the God and I had the honour to see them in their entirety. I shall present only two of them since the others will be hardly clear. The fourth precept says: 'Strong impact', the fifth: 'Calculated pressing'. These are precepts of liberation... Everyone can follow them, anyone in the world, on the exact execution of the instructions of the prophet.[18]

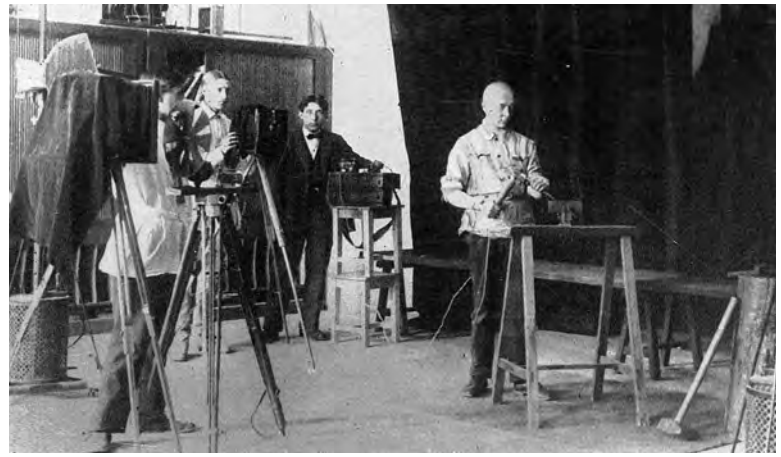


fig 3.30 The Central Institute of Labour (CIT), Moscow, Petrovka 24. 1923. René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926. Courtesy of Jon Appleton.

fig 3.31 Chrono-cyclegraphic photography in the Biomechanical Laboratory of CIT. 1923. René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926. Courtesy of Jon Appleton.

fig 3.32 Working process in the CIT courtyard. Gastev is on the far right; Bernstein is second from the left. René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926. Courtesy of Jon Appleton.

18 Fülöp-Miller, R. 'Die Machinenanbeter'. *Vossische Zeitung*, Berlin, 13 October 1923, #485, p.3. Russian trans. by S. Nikritin. RGALI f. 2717 Nikritin. Op.1 e.h. 95. A205. English trans. by A. Smirnov.

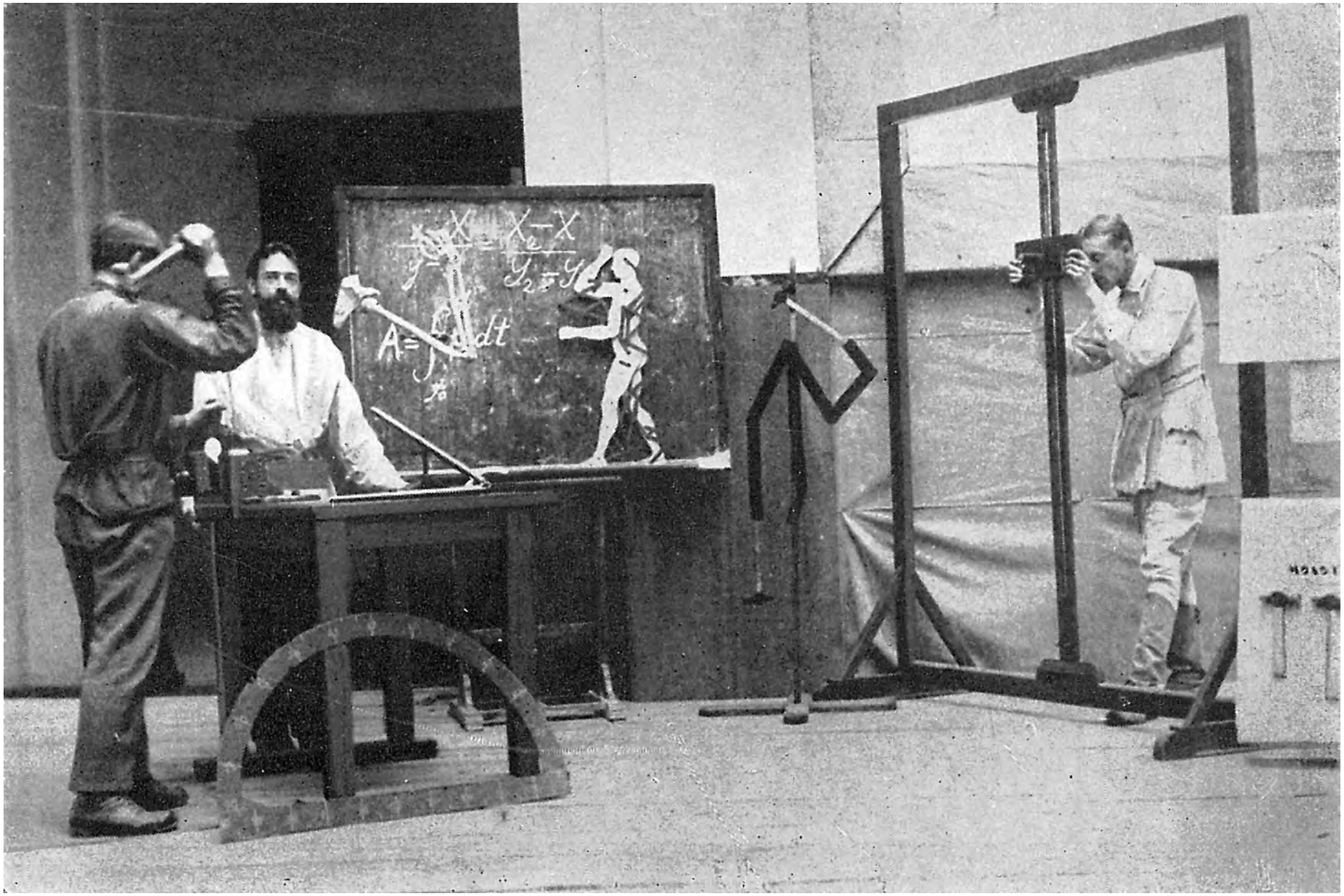
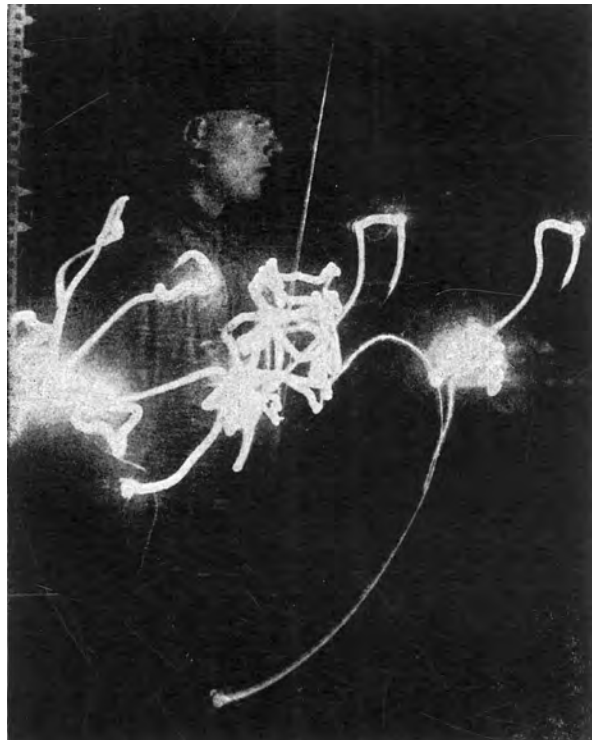


fig 3.33 Movement research in the CIT laboratory. 1923. René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926. Courtesy of Jon Appleton.



figs 3.34-35 Early cyclograms of movements, produced by Bernstein at CIT in 1921-23. Photographs from the book by René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926. Courtesy of Jon Appleton.

fig 3.36 Portrait of Gastev by Z. Tolkachev. Illustration from Gastev's *Revolt of Culture*, Harkov, 1923. Courtesy of L. Pchelkina.

ALEXEI GASTEV (1882-1939), writer, politician and polymath. Gastev was one of the most popular and outstanding proletarian poets of early post-revolutionary Russia. Gastev's influence on contemporaries and culture as a whole was considerable. As poet Nikolay Aseev described him in 1922 in his poem 'Gastev': 'Ovid of miners and metalworkers'.[19] Among his numerous followers were composer Arseny Avraamov, producer, director and actor Vsevolod Meyerhold, physiologist Nikolai Bernstein and many involved in the 'scientific organization of labour' (in Russian transliteration — Nauchnaya Organizacia Truda (NOT)).

Born to a teacher and a seamstress in Suzdal, Russia, Gastev enrolled in the Moscow Pedagogical Institute, but was expelled after participation in a revolutionary meeting. Shortly after that Gastev was arrested and exiled to northern Russia. As a result of his exile, followed by emigration, in 1910-13 Gastev spent three years working in the industrial factories of Paris, including at the Renault automobile factory.

After the October Revolution, Gastev returned to Russia. In 1918 he established a network of trade unions according to the model of the French syndicalists. 'Each turner is a director of the machine tool,' he constantly emphasized. 'We put a resolute end to division into the so-called executive personnel and the personnel of management.'[20] From its inception he had been the main ideologist of Proletkult.

Gastev was allegedly a personal acquaintance of, and in correspondence with, Henry Ford. Fascinated by Taylorism and Fordism, he led a popular movement for the 'scientific organization of labour' which considered increasing automaticity and standardization of workers' movements, language, and even thoughts as means for

19 Aseev, N. *Stihotvorenia i poemi*. Sovetski pisatel, Moscow, 1967.

20 Karpichev, A. 'Nestandartni Gastev' (Non-standard Gastev), *Standarti i kachestvo* magazine, Moscow, N9, 2004. Trans. AS.

improving the efficiency of labour. He was convinced that his main artistic creation was CIT — the Central Institute of Labour which was founded in 1920 and supported by Lenin. In 1928 after an inspection of CIT laboratories the famous proletarian poet Maxim Gorki embraced Gastev and, referring to his departure from poetry, commented: 'Now I understand why you have discarded fiction: the one is at the expense of the other.'[21]

Meanwhile in 1921 at the All-Russian Scientific Management Conference, organized by Leon Trotsky, and held in Moscow, Platon Kerzhentsev, a Left Communist and the leading critic of Gastev, proposed an alternative to Gastev's work. It was a 'black mark' for Gastev. In totalitarian Russia in the 1930s Kerzhentsev became a leading theorist and organizer of scientific management in the Soviet State, based on the principles of vertical authority. The totalitarian State of the 1930s was opposed to the creation of an anarchical network of socially engineered Cyborgs with liberated minds. In 1938 Alexei Gastev was arrested on false charges of 'counter-revolutionary terrorist activity' and sentenced to death by a speedy trial; his institute was closed. On 15 April 1939 Gastev was shot to death in the suburbs of Moscow.

ORDER 05

Funeral rites at the cemetery of planets.
A howl in the catacomb of worlds.
Millions, into the manhole of the future.
Billions, weapons stronger.
Labour camp of the mind.
Chains of the heart.
Engineer Everyman.
Drive geometry into their necks.
Logarithms into their gestures.
Defile their romanticism.
Tons of indignation.
Normalize the word from pole to pole.
Phrases on the decimal system.
A boiler company for speech.
Annihilate verbality.
Make the tunnels resound.
Turn the sky red for arousal.
Gears—at superspeed.
Brain machines—high load.
Cinema eyes—fix.
Electric nerves—to work.
Arterial pumps, activate.

Alexei Gastev. 1921[22]

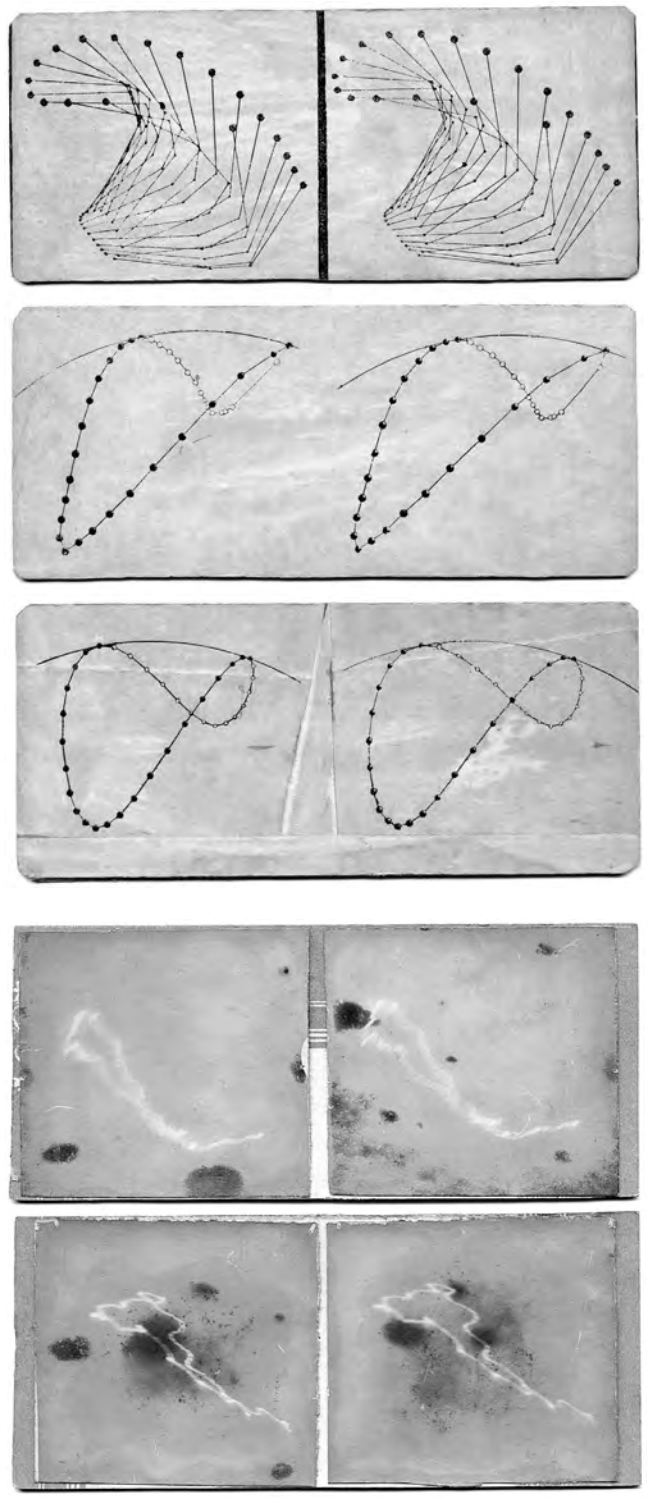


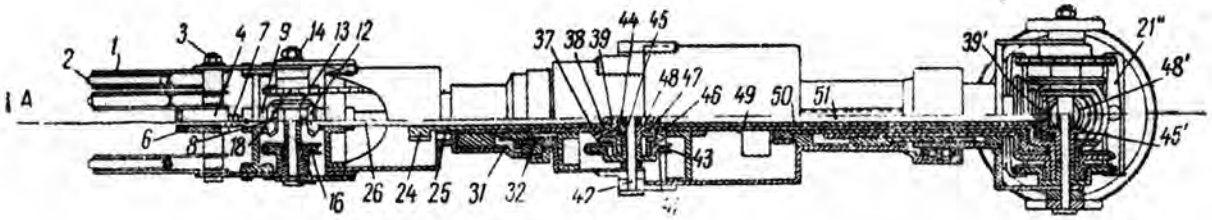
fig 3.37 Stereo traces of hand movements. Research work at GIMN in collaboration with Gastev's institute CIT, Moscow. 1925. (Nikolai Bernstein and Tatiana Popova). GIMN archive. TCA.

21 *Ibid.*

22 Gastev, A. Order 5. *A Packet of Orders*. Trans by Greg Afinogenov.

fig 3.38 'The Worker and the Machine'. Caricature of Alexei Gastev in the magazine *Smena*, N.16-17, 1930, p.29. AS library.

fig 3.39 CIT poster. 'Let's take the snow-storm of the revolution in the USSR, let's put in the rhythm of American life and perform well-adjusted work like a chronometer'. From the book by A. Gastev *Youth, go!*, VCSPS, Moscow, 1923.



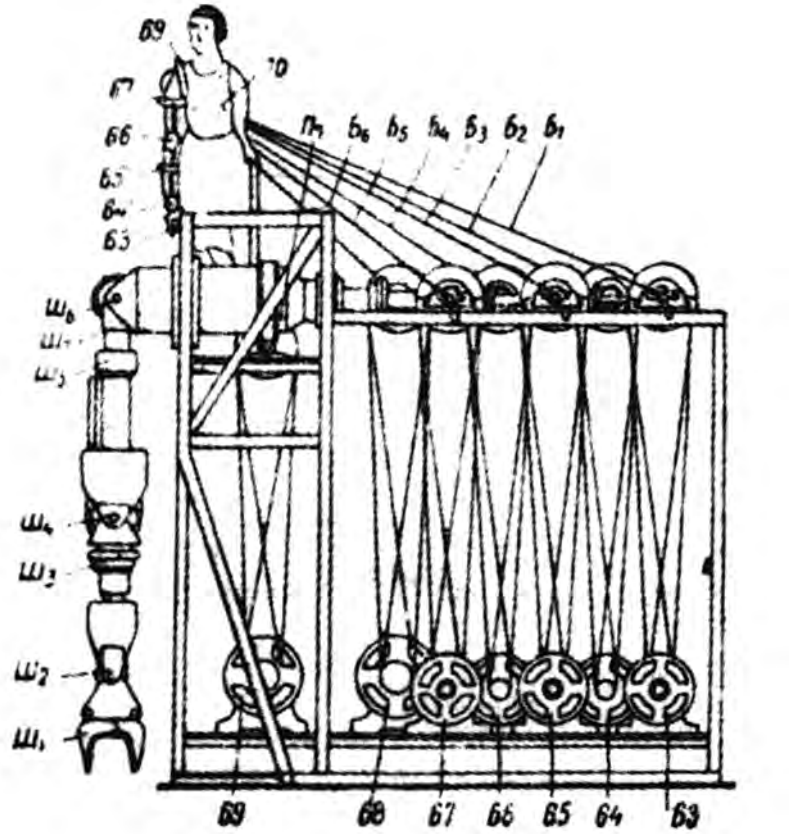


fig 3.40 The construction of the ANDROID's extremity. Polytechnic Museum, Moscow.

fig 3.41 The construction of the ANDROID. Polytechnic Museum, Moscow.

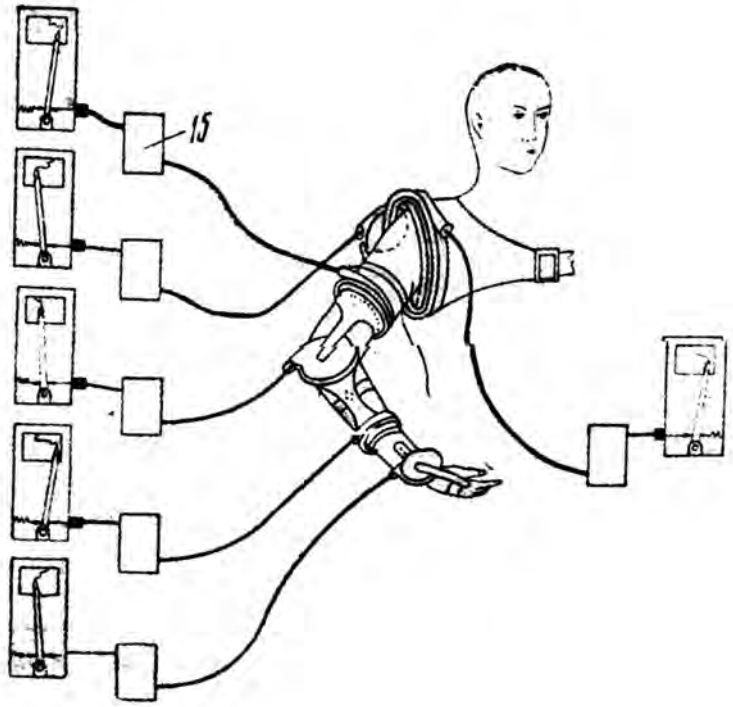


fig 3.42 Schematic diagram of an instrument for recording the movements of the human body. Polytechnic Museum, Moscow.

ANDROID

Living through famine, cold and poverty, creative people were dreaming about the future world, where the human would become perfect with the body working as a machine, leading to new experiences, increased power and liberated minds. They expected a worldwide revolution. Some were even planning further expansion into space.

The Soviet rocket scientist and pioneer of cosmonautic theory Konstantin Tsiolkovsky inspired leading Soviet rocket engineers and contributed to the early success of the Soviet space program. He influenced rocket scientists throughout Europe.

One of the followers of Tsiolkovsky was a forgotten space pioneer by the name of Ary Sternfeld (1905-80), who was the first to calculate the best trajectories to reach the Moon and Mars. He introduced the word 'cosmonautics' into the language of science in 1932. Sternfeld's unusual life journey took him from a Polish province, which at that time belonged to the Russian Empire, to France and finally to the Soviet Union. During his life he experienced recognition, he faced danger, and he suffered indignity. In 1931 he patented an instrument for the registration of movements of the human body,[23] which was the basis of a system called the ANDROID, patented somewhat later in 1938.[24]

23 USSR Copyright Certificate No. 57 746, applied for 9.04.1931.

24 USSR Copyright Certificate No. 67 162, applied for 3.09.1938.

The mechanical extremity offered by the author was to be made of parts including rotary joints in relation to each other and set in motion from the central control unit by means of mechanical transmission from the servomotors. The transmission would consist of several systems, concentrically located hollow shafts connected at joints by means of conic gears. Sternfeld believed that with such mechanical extremities, for example, a hand, it would be possible to force the machine to repeat all movements carried out by the person operating it. The person operating the machine would achieve this by putting on special transducers of impulses on one hand. Each movement of the transducer would cause the movement of the contacts of servomotors in a certain direction. In this way, control over actions beyond the reach of humans could be automated. Sternfeld envisioned this system as an important component of a future expedition to Mars.

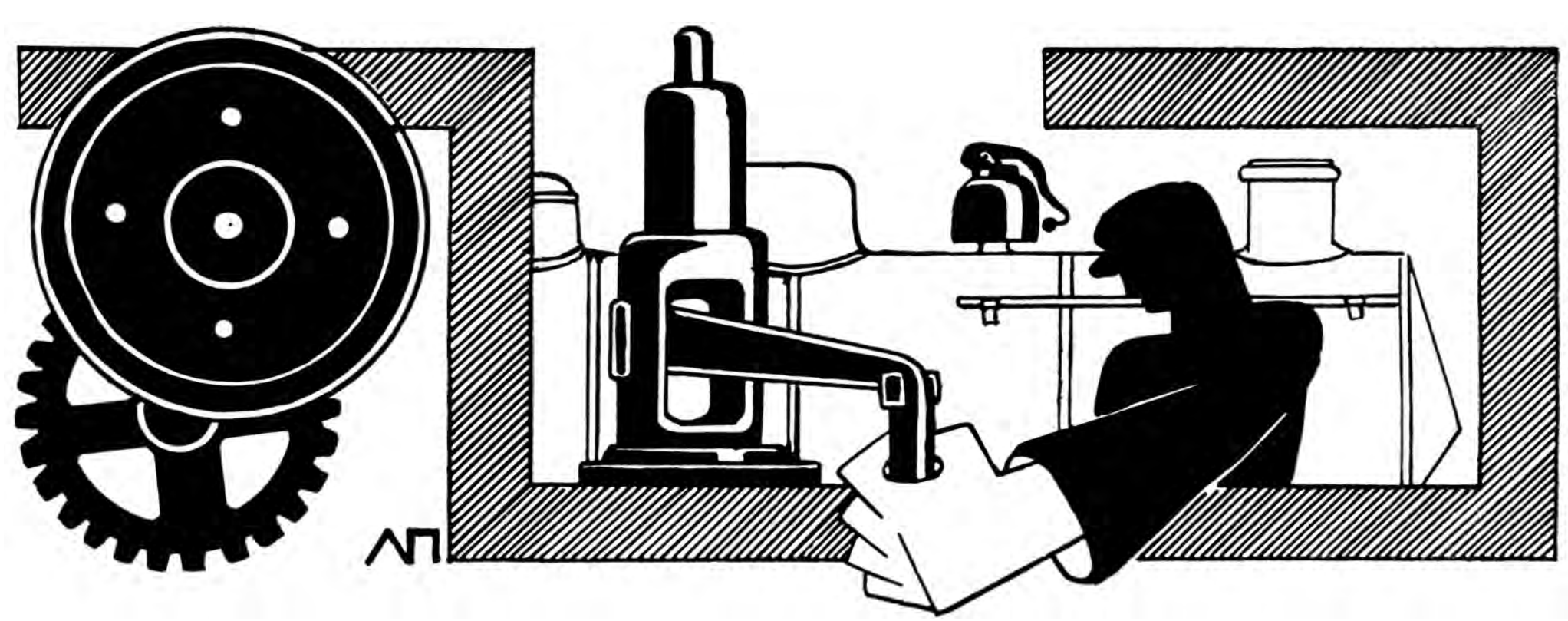


fig 3.43 Liubov Popova. Illustration for the magazine *Muzikalnaya Nov'* (Musical Novelty), 1922. Lithograph. Museum for Modern Arts, Thessaloniki.

fig 4.1-2 Nikolai Bernstein and Nikolai Tikhonov during an experiment on cyclography. TCA.

4. THE ART OF MOVEMENT

BIOMECHANICS

Physiological research at the Central Institute of Labour (CIT) was based on the conceptual approaches and experimental methods of the European science of biomechanics, in which the human body was represented by a mechanical system of muscle forces and weights. In a 1926 textbook for biomechanics instructors, Bernstein wrote: 'Biomechanics... is a science that studies how the living machine, that is every one of us, is built, how its moving parts are organized, and how they work... The laws of mechanics are the same everywhere, no matter whether they concern a steam locomotive, a lathe, or a human machine. Therefore, we do not have to derive some new, special mechanical laws. We must only compile a description and the characteristics of this living machine in the same way as we would do it for an automobile or a loom.'[1]

Meanwhile, the activities of CIT went far beyond pure applied practicality. In 1921 Alexei Gastev, Nikolai Bernstein and Vsevolod Meyerhold brought the term biomechanics into common use not only in the psychology of labour, but also in theatrical practices, in particular, by Meyerhold and Solomon Nikritin. Their concepts, alongside the ideas of other outstanding representatives of this generation — such as the scientist-naturalist Alexander Bogdanov and the Russian Orthodox theologian, philosopher, mathematician and inventor Pavel Florensky — formed the conceptual basis for the development of many radical artistic concepts and experiments. In one of Gastev's exhibitions of the 1920s entitled 'Art of Movement', accompanying performances of Solomon Nikritin's Projection Theatre, stereo images traced the physical trajectories of tools, hammers, weapons, the corporeal joints of workers, pianists and sportsmen, tracking and monitoring the three-dimensional characteristics of motion.

Most of the documentation included in the exhibition was produced by Bernstein — the CIT's leading physiologist — who conducted experiments measuring the trajectories and speed of human limbs while his subjects performed various labour tasks. One of Gastev's hopes was to stage a labour championship in addition to sports events. In a poem 'Answer urgently!' (1919-22) Gastev describes the competition, where the skilled copper-smith works with rhythm like a virtuoso percussionist: '...Do you want? I shall strike the anvil with a hammer striking the first quarter of a minute in a tempo 120, the second quarter — 90, the third — 60. And he started. A boilermaker from Dublin has been recognized as the champion of rivets. It was? It will be!'[2]

1 Bernstein, N.A. *Biomekhanika i fiziologiya dvizheniy*, edited by Vladimir P. Zinchenko. Moscow and Voronezh: MODEK. [1926], 1997.

2 Gastev, A., *Poezia rabochego udara,* Moscow, 1971. Trans. AS.

fig 4.3 Nikolai Bernstein. c. 1948. Courtesy of Vera Talis.

NIKOLAI BERNSTEIN (1896-1966), was responsible for developing ideas relevant to many disciplines that constitute the human movement sciences, placing him ahead of his time by twenty to fifty years. As a young boy he wanted to become a linguist, but his plans were affected when he was eighteen by the outbreak of the First World War. Owing to the number of physicians needed in the army, Bernstein opted to study medicine.

From 1921-23 Bernstein was the leading physiologist at the Central Institute of Labour. Until 1947 he worked at the National Central Institute of Physical Culture in Moscow, where he was head of the scientific department. In 1947 he won the very prestigious national prize (known as the Stalin Prize) for his famous book *O postroyenii dvizheniy* (On construction of movements), in which he presented a five-level system for the construction of movements. Regrettably, somewhat later he was accused of political disloyalty and was removed from his position. Deprived of the possibility to undertake experimental work and without direct contact with the Institute, he set about creating a new branch of science: physiology of activity. He also increasingly devoted his attention to cybernetics. While he continued to make a significant contribution to these fields, Bernstein's ideas were not allowed to grow and flourish as they deserved to. Before the end of his life he still managed to author the book *The Co-ordination and Regulation of Movements* — which until 1996 was the only book by Bernstein to have been published in English.

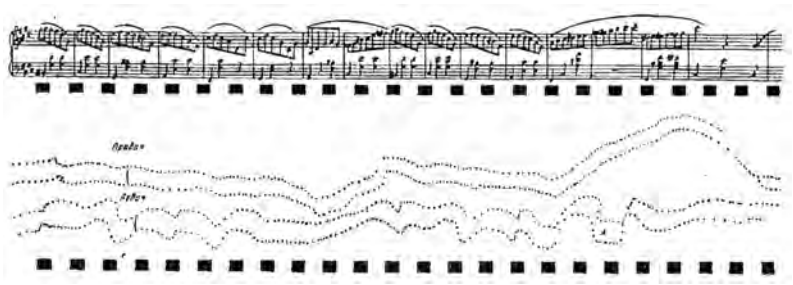


fig 4.4 Spatial kymocyclograms of a piano performance of the *7th Waltz* by Chopin. Two lamps were mounted on each hand. Reproduced in N. Bernstein, *O postroenii dvizheniy* (About the building of motion), Moscow, 1948.

fig 4.5 Vsevolod Meyerhold working at the Telegraph Radio Theatre. c. 1932. Courtesy of Boris Kaplan.

VSEVOLOD MEYERHOLD (1874-1940) The Russian Revolution of 1917 made Vsevolod Meyerhold one of the most enthusiastic activists of the new Soviet Theatre. Meyerhold founded his own theatre in 1922, which was known as The Meyerhold Theatre and lasted until 1938. Meyerhold fiercely confronted the principles of theatrical academism, claiming that they were incapable of finding a common language that could reflect the new reality. The actors participating in Meyerhold's productions acted according to the principles of biomechanics, a system of actor training that was later taught in a special school created by Meyerhold. Meyerhold connected psychological and physiological processes and focused on learning gestures and movements as a way of expressing emotion outwardly. He developed a number of body expressions that his actors would use to portray specific emotions and characters.

Meyerhold was strongly opposed to socialist realism, and at the beginning of the 1930s, when Stalin was clamping down on all avant-garde art and experimentation, his works were proclaimed antagonistic and alien to the Soviet people. His theatre was closed down in January 1938. In 1939, Meyerhold was arrested and accused of anti-government political activities. Sentenced to death by firing squad on 1 February 1940, he was executed the following day.

THE PROJECTION THEATRE

The Studio of the Projection Theatre was one of the most avant-garde theatre groups of the time, established by Solomon Nikritin and Sergey Luchishkin on 10 January 1922 within VKHUTEMAS.[3] The Projectionists organized a theatre of 'projects', one that reduced and dissected the fundamentals of rhythmic movement and individual speech sounds, presented in

3 VKHUTEMAS (Higher Art and Technical Studios) was the Russian state art and technical school founded in 1920 in Moscow.

fig 4.6 (Left + Right images) Physical trajectories of the corporeal joints of a wired pianist. Stereo images, CIT & GIMN, Moscow. 1925. (N. Bernstein and T. Popova). GIMN archive. TCA.

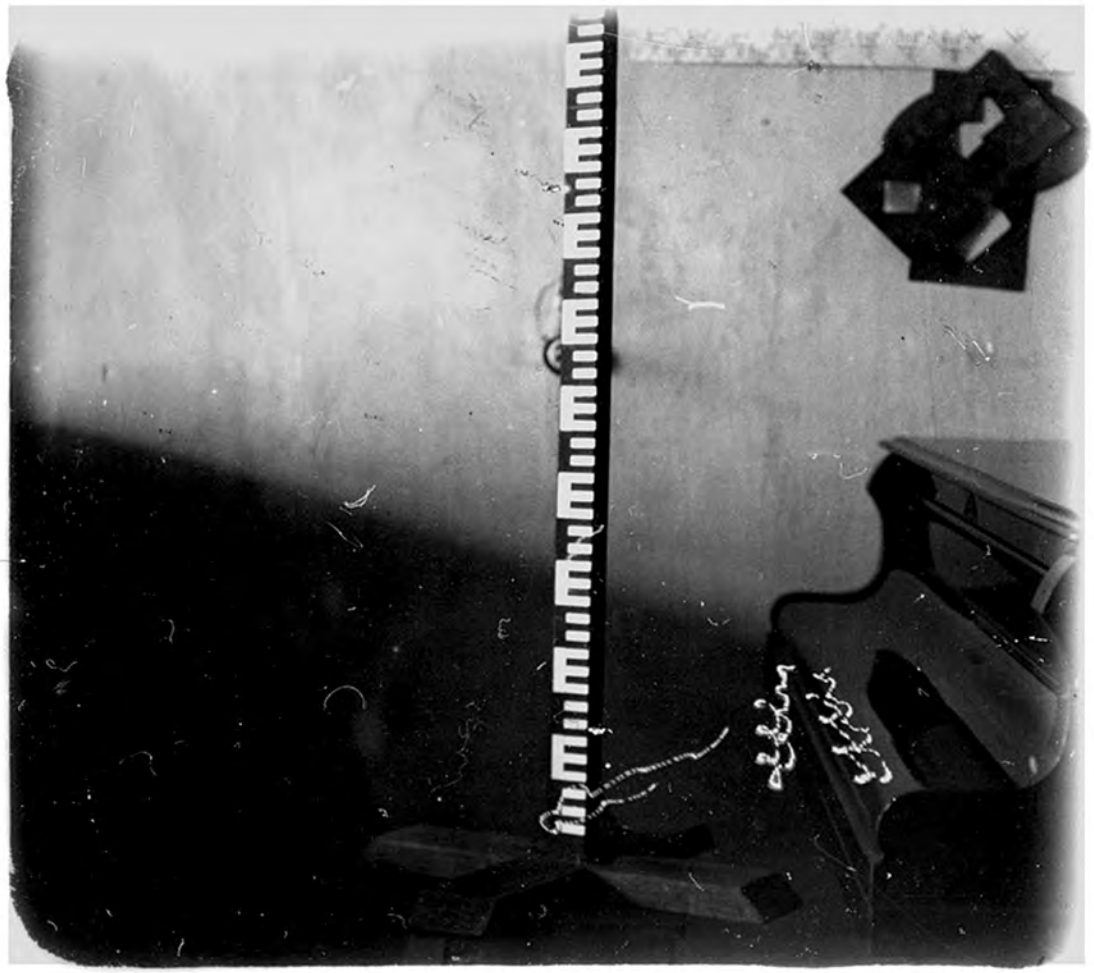


fig 4.7 (L + R images) Physical trajectories of the corporeal joints of a wired pianist. Stereo images, CIT & GIMN, Moscow. 1925. (N. Bernstein and T. Popova). GIMN archive. TCA.

and around mobile, abstract sets, working out the expressive possibilities of theatre by means of the essential properties of movement, setting and sound. The theatre's activities were governed by Nikritin's theory of Projectionism.

Among the members of the Projection Theatre were Nikritin, Piotr Vil'iams, Luchishkin, and Anna Amkhanitskaia. At the same time Nikritin, together with Kliment Red'ko, organized a group of Projection artists that came to be known as 'Elektro-organism',[4] later renamed the 'Method' group. This also included Luchishkin, Mikhail Plaksin, Alexander Tyshler, Nikolay Triaskin, Alexander Bogatirov and Alexander Svobodin. 'Prince Sergei Volkonsky's interpretations of the work of European music and movement theorists François Delsarte and Emile Jaques-Dalcroze served as the platform upon which Nikritin and Svobodin constructed their 'scores' of sounds, gestures and movements for the Projection Theatre. Rhythm was another subject that united the young Dalcrozian researchers.'[5]

After rejecting the Club of the *Anarchists-Inter-Individualists* as a training area,[6] the Projection Theatre was hosted by CIT and became a kind of proving ground of the future. 'Gastev offered to transfer the Theatre to the CIT headquarters and to orient the "work of the Studio... towards organizing the expression of labour methods on stage, towards creating an objective theatre of contemporaneity and, ultimately, a theatre of normalized labour."'[7] In turn, Gastev was appointed 'honorable member' of the Projection Theatre. As of October 1923 the Projection Theatre functioned in close collaboration with CIT, especially Nikolai Bernstein and Nikolai Tikhonov (director of the two laboratories — bio-mechanical and photo-cinematographic — founded in 1922 for the 'scientific' study of movement). According to Luchishkin:

We started to implement our experimental concepts by working up action scores by analogy with a piece of music, composing them out of different parts together with different rhythmo-dynamic characteristics. After that, we looked for the form of plastic expression in each part within the movement of the body, for the development of this movement, and for its nuances and transitions, including vocal resonance. All this was tinged by the emotional score which became the basis of the entire action.

For example, the general rhythmo-dynamic design of one part was slow and spasmodic, passing into muffled blows. Here is the emotional, imagistic content: night, quietude, heavy mist, measured dripping of water, you can hear a noise growing louder – horses galloping, an alarm sounding, preparations for an auto-da-fé on the square. The part ends with pacification. The people go their separate ways after vespers before Palm Sunday, the lights of the candles twinkle. All this becomes a basis for the composition of movement and sound together with their emotional colouring. Each participant elaborated his line of action, while Nikritin coordinated and consolidated everything.[8]

René Fülöp-Miller — an Austrian cultural historian, journalist and writer, impartial and candid observer and, perhaps, a rare example of someone who managed to keep his own inner perspective free from the tyranny of sterile ideologies during his prolonged stays in Soviet Russia, described a performance by the Projection Theatre as follows:

In the most up-to-date 'left' playhouse, the 'Projection Theatre', there is no stage at all. The performance takes place in the middle of the hall, and all the appliances used are exclusively gymnastic apparatus, the 'piece' is accordingly nothing but a three-hour display of gymnastics, jumping, and running backwards and forwards, and as it is allied with the most extraordinary physical distortions, it makes an impression of complete insanity...

There is nothing for the European to do but listen, look, and marvel, and realize with increasing clearness that everything that happens in Russia is in all its manifestations fundamentally different from our traditions and our experience.[9]

At the premiere, the illumination had to be improvised, 'consisting of numerous candles hastily purchased since, in his alarm and consternation, the Labour School headmaster had boycotted the performance by switching off the electricity'.[10] Meanwhile, the futurist poet Alexei Kruchenykh, among other avant-garde invitees, was unruffled: 'This evening, by candlelight, we are looking forward to a new theatre, the theatre of our great future which will upset all the dogmas of philistine pretence.'[11]

Many accomplishments of the multimedia technologies of the late 20th century had already been pioneered in the performances of the Projection Theatre in the 1920s. Together with all kinds of gymnastic apparatus and the noise orchestra, the Projection Theatre used mobile scenery, moving constructions (designed by Triaskin) for the actor-acrobats. Special projectors were included in the script of the spectacle 'Pressing and impact' as well as big screens behind the stage to produce a dynamical film projection as an active virtual part of the performance. According to Nikritin, this was the first time that the stage had been the recipient of 'dynamic constructions'.[12]

4 In December 1922 Red'ko launched a manifesto of Electro-organism calling for the blend of art with physics and technology, politics and medicine, and a psycho-philosophical system based on an 'inter-social environment' fostering interplanetary relations.

5 Pchelkina, L. 'The Biomechanics of Voice and Movement in Solomon Nikritin's Projection Theatre (1920s)'. In the collection *Electrified Voices*, Dmitri Zakharine and Nils Meise (Eds.), Universität Konstanz, Germany, 2011 / V&R unipress, 2012, p.152.

6 Misler, N. 'The Art of Movement'. Catalogue *Spheres of Light — Stations of Darkness. The Art of Solomon Nikritin*. State Museum of Contemporary Art, Thessaloniki, 2004, p.365.

7 *Ibid*.

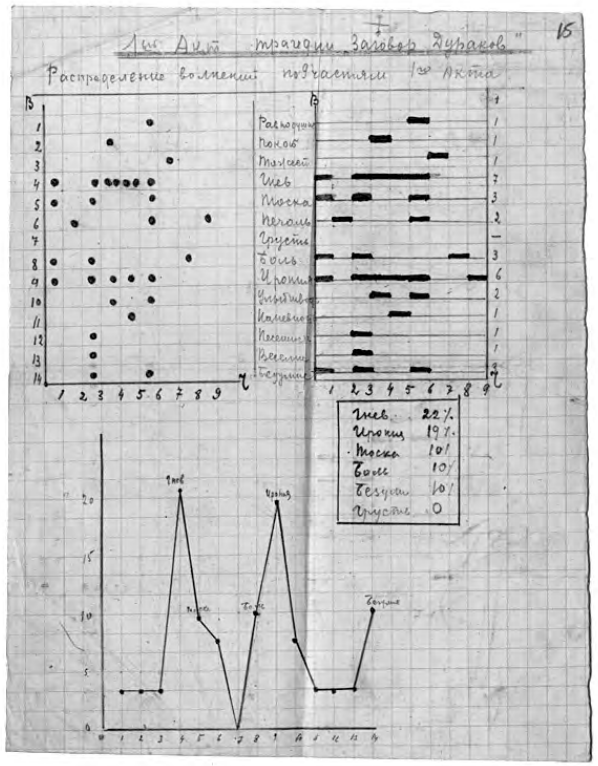
8 Misler, N. 'The Art of Movement'. Catalogue *Spheres of Light — Stations of Darkness. The Art of Solomon Nikritin*. State Museum of Contemporary Art, Thessaloniki, 2004, p.364.

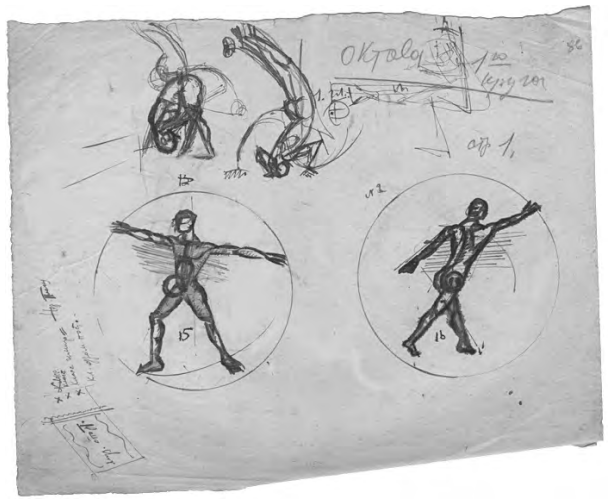
9 Fülöp-Miller, R. *The Mind and Face of Bolshevism*. Chiswick press, Charles Whittingham and Griggs (printers), LTD, London, 1927, p.132. First published as *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926.

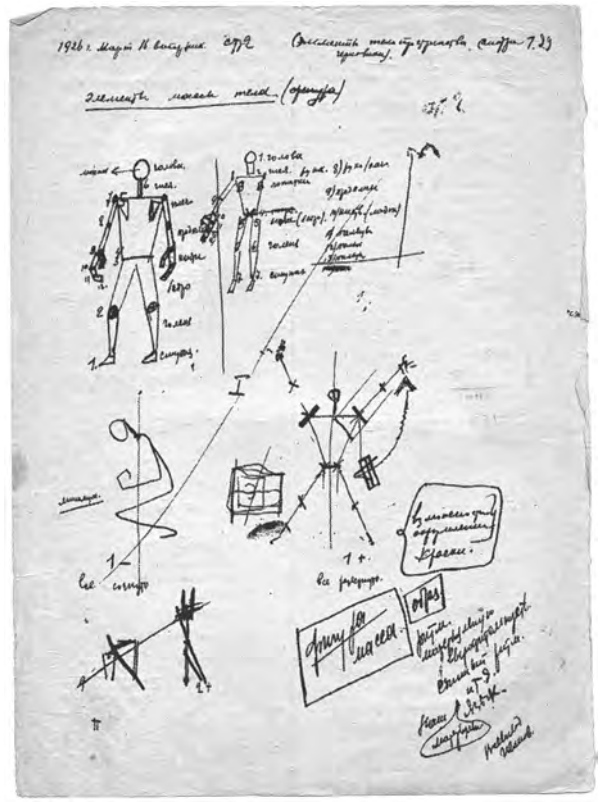
10 Misler, N. 'The Art of Movement'. Catalogue *Spheres of Light — Stations of Darkness. The Art of Solomon Nikritin*. State Museum of Contemporary Art, Thessaloniki, 2004, p.364.

11 *Ibid.* Guests included Alexander Drevin, Vasily Kamensky, Liubov Popova, Alexander Rodchenko, Il'ia Shlepianov and Nadezhda Udaltsova.

12 *Ibid.*







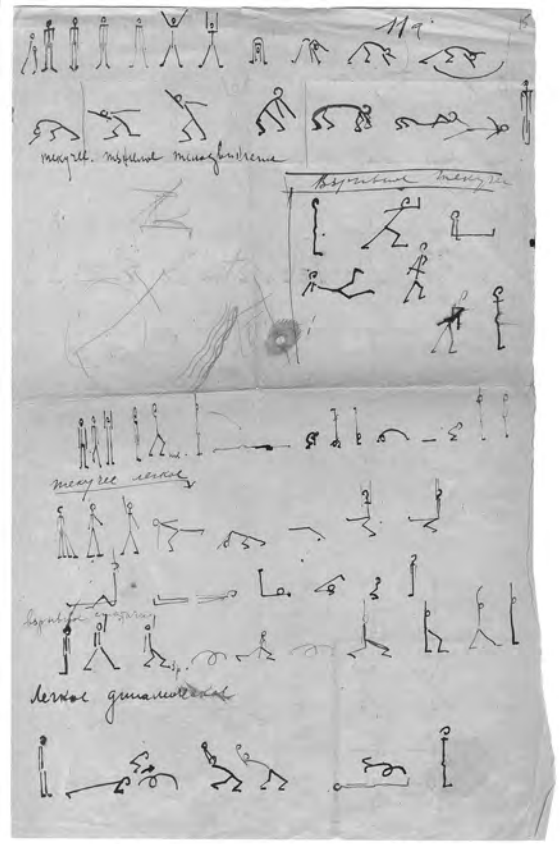


fig 4.8 Solomon Nikritin. 1922. Statistical graphs of distribution of the quantitative and qualitative presence of the various excitements (emotional states) in the first act of *Conspiracy of Fools* at the Projection Theatre. Nikritin compiled a first tabulation specifying the distribution of various emotions in time such as anger, melancholy and sadness, reducing them to percentages and placing them on a graph. Pchelkina, L. 'The Biomechanics of Voice and Movement in Solomon Nikritin's Projection Theatre (1920s)'. In the collection *Electrified Voices*, Dmitri Zakharine and Nils Meise (Eds.), Universität Konstanz, Germany, 2011 / V&R unipress, 2012, p.159.

fig 4.9 Solomon Nikritin. c. 1922. This diagram represents an attempt at the classification and typology of human movements, based on the principles of biomechanics and musical harmony. In this particular case Nikritin illustrates the notion of the 'Octave' — the maximum area mechanically reachable by the dancer with their feet in a fixed position. Pchelkina, L. 'The Biomechanics of Voice and Movement in Solomon Nikritin's Projection Theatre (1920s)'. In the collection *Electrified Voices*, Dmitri Zakharine and Nils Meise (Eds.), Universität Konstanz, Germany, 2011 / V&R unipress, 2012, p.157.

fig 4.10 Solomon Nikritin. Mid 1920s. Diagrams of the movements of Projection Theatre actors, based on principles of Biomechanics. At that time the theatre was based at the CIT Institute. Courtesy of Liubov Pchelkina.

fig 4.11 Solomon Nikritin. C. 1922. This manuscript illustrates an attempt to develop the typology and classification of human movements and gestures based on principles and terms related to musical harmony and acoustics, developing a kind of biomechanical temperament and scale. Courtesy of Liubov Pchelkina.

For the first act of *Conspiracy of Fools*, which was divided into nine parts, Nikritin compiled a first tabulation specifying the distribution of various emotions in time such as anger, melancholy and sadness, reducing them to percentages and placing them on a graph.[13] ■

fig 4.8

'The premiere of *Conspiracy of Fools* was also accompanied by an exhibition in the foyer of the Moscow Hall of Columns of Luchishkin's colour research, Triaskin's constructions and a substantial section of didactic and anatomical drawings and tables — kinetic images with which Nikritin was visualizing the movements of bio-mechanics.'[14]

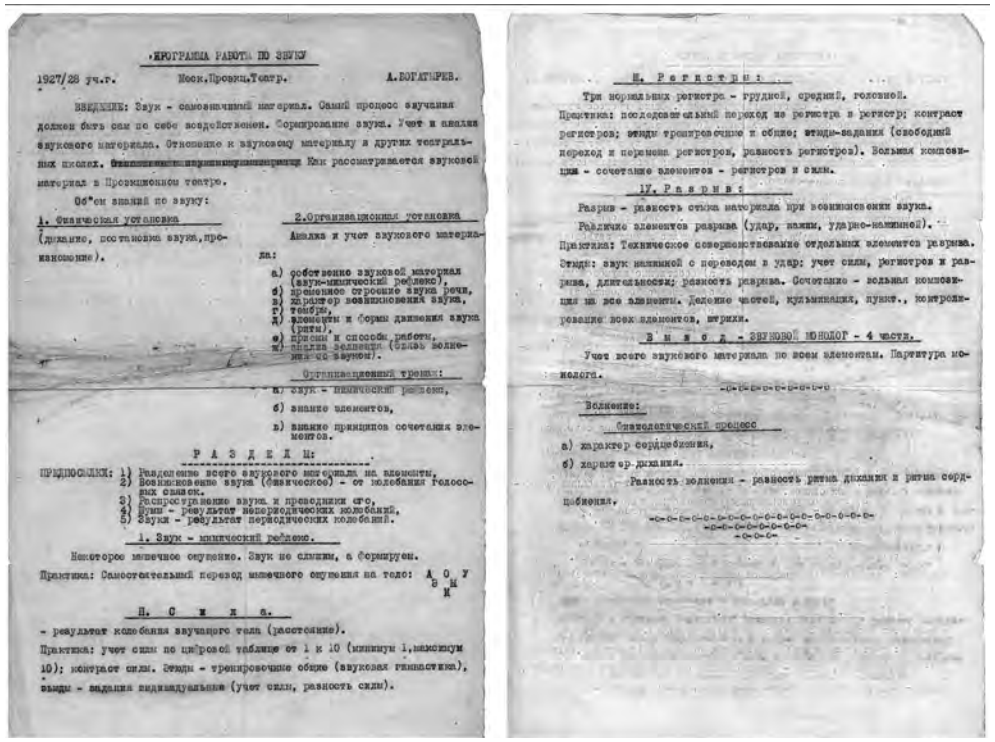
fig 4.12 Solomon Nikritin. c. 1920. Courtesy of Liubov Pchelkina.

SOLOMON NIKRITIN (1898-1965) Artist, painter and art theorist, he was born in Chernigov. In 1915-16 he attended art lessons at the private studios of M. Leblan and L. Pasternak in Moscow. In 1917 he attended lessons in the studios of A. Yakovlev, M. Dobuzhinsky and E. Lanceray in Petrograd, and in 1918 he took lessons at A. Exter's studio in Kiev. In 1921-22 he attended VHUTEMAS (Higher Arts and Crafts studios) classes in Moscow, conducted by Wassily Kandinsky and the head of the IZO department of the Ministry of Culture, David Shterenberg.

Like many other avant-garde artists, Nikritin himself was involved in the Proletkult workshops in Moscow in 1921. The same year he founded the latest group of avant-garde fine arts in Russia, called Projectionists (or the Method). A year later he founded the Studio of Projection Theatre. In 1924 he took part in the First Discussional Exhibition of the Associations of Active Revolutionary Art. From 1925-29 Nikritin was president of the Art Research Council of the Museum of Painterly Culture (MPC) and the head of its Analytical Cabinet, where he led experimental research work. MPC was the only State-funded museum intended to collect works of the avant-garde. The MPC collection was the biggest in Russia. As of 1930 Nikritin was the main designer at Moscow Polytechnic Museum, and from the mid 1930s until 1941 he was the designer of the All-Union Agricultural Exhibition in Moscow.

From 1932-34 Nikritin was the head of the Department for Visual Art at Moscow Polytechnic Museum. He joined the Methodology Bureau and the Exhibition Commission, taking part in reconstruction work. He was among the first to create a method for exhibition design whereby each exposition has a script of its content and stylistic direction.

In the early 1930s, during the epoch of Socialist Realism, the Moscow Union of Artists accused Nikritin of formalism. After that his paintings were never exhibited in Russia. Most of the works and writings from his private archive ended up in the collections of Georgy Kostakis and Igor Savitsky and were divided between the State Tretyakov Gallery in Moscow, the Museum of Modern Art in Thessaloniki and the Karakalpakstan State Museum of Art in Nukus (Uzbekistan). Nowadays Solomon Nikritin is mainly recognized as an avant-garde painter and draughtsman; his art criticism and philosophical theories as well as his experiments in the field of theatrical culture related to the biomechanics of movement and sound are almost entirely forgotten.



«ПРОГРАММА РАБОТЫ ПО ЗВУКУ

1927/28 уч.г. Моск.Провинц.Театр. А.БОГАТЫРЕВ.

ВВЕДЕНИЕ: Звук - самостоятельный материал. Самый процесс изучения должен быть сам по себе возбудителен. Сорганизование звука. Учет и анализ звукового материала. Отношение к звуковому материалу в других театральных школах. Как рассматривается звуковой материал в Провинциальном театре.

Об'ем знаний по звуку:

1. Физическая установка (движение, постепенно звука, прекращение).

2. Организационная установка. Анализ и учет звукового материала:

а) собственно звуковой материал (акустико-мышечный рефлекс),
б) временное строение звука речи,
в) характер возникновения звука, г) тембры,
д) элементы и формы движения звука (ритм),
е) приемы и способы работы,
ж) анализ волнения (связь волнения со звуком).

Организационные уровни:

а) звук - мышечный рефлекс,
б) знание элементов,
в) знание принципов сочетания элементов.

Р А З Д Е Л I:

ПРЕДПОСЫЛКИ: 1) Разделение всего звукового материала на элементы,
2) Возникновение звука (физическое) - от колебания голосовых связок.
3) Распространение звука и проводники его.
4) Шум - результат непериодических колебаний,
5) Звук - результат периодических колебаний.

1. Звук - мышечный рефлекс.

Некоторое мышечное ощущение. Звук не слышим, а формируем.

Практика: Самостоятельный перевод мышечного ощущения на тело: А О У Э И М

Н. С л и я н и е.

- результат колебания звучащего тела (расстояние).

Практика: учет силы по цветовой таблице от 1 к 10 (минимум 1, максимум 10); контраст силы. Этюды - тренировочное общее (звуковая гимнастика), этюды - задания индивидуальные (учет силы, разность силы).

II. Регистры:

Три нормальных регистра - грудной, средний, головной.

Практика: последовательный переход из регистра в регистр; контраст регистров; этюды тренировочные и общие; этюды-задания (свободный переход и перемена регистров, разность регистров). Большая композиция - сочетание элементов - регистров и силы.

IV. Разрыв:

Разрыв - разность стыка материала при возникновении звука.

Различие элементов разрыва (удар, взлом, ударно-взломный).

Практика: Техническое совершенствование отдельных элементов разрыва. Этюды: звук взломной с переходом в удар: учет силы, регистров и разрыва, длительности; разность разрыва. Сочетание - большая композиция на все элементы. Деление частей, кульминация, пункт., контролирование всех элементов, штрих.

В ы в о д - ЗВУКОВОЙ МОНОЛОГ - 4 части.

Учет всего звукового материала по всем элементам. Партитура монолога.

Волнение:

Физиологический процесс

а) характер сердцебиения,
б) характер дыхания.

Разность волнения - разность ритма дыхания и ритма сердцебиения.

fig 4.13 Sergey Luchishkin. Single page from the programme of the Projection Theatre Workshops, including courses on Movement, Excitement, Acoustics, Scenic Construction and Scenic Analysis. Courtesy of Liubov Pchelkina.

13 *Ibid.*

14 *Ibid.* p.365.

PROJECTION THEATRE WORKSHOPS

Actors in the Projection Theatre Workshop were expected to master CIT techniques and methodologies and to practise the most complicated scores of sounds, gestures, movements and emotional states. Undergoing daily exercises and psycho-training, these actors played the role of living models for the socially engineered 'Human Machines' of the future.

Intensive workshops, developed at the Projection Theatre, included courses on movement, excitement, acoustics, scenic construction and scenic analysis. For instance, the *Program on Sound,* developed by Alexander Bogatirov in 1927-28 included not only the acoustical basis of sound production and spatialization, but also biomechanical, psychological and physiological aspects of vocal sound production during theatrical performance. The sounds of voices and speech of the group of actors were divided into small segments and syllables, forming a dense stream of sound, developing according to a special score, a kind of gesture language as the carrier of emotion and meaning.

PROJECTION THEATRE. PROGRAM ON SOUND.[15]

INTRODUCTION: *Sound is a self-sufficient material. The process of sounding itself should be influential. Formation of the sound. Inventory and analysis of the sound material. The attitude to sound material in other theatrical schools. The way the sound material is considered at the Projectionist Theatre.*

KNOWLEDGE OF SOUND: *Physical installation*
Breathing, adjustment of sound, pronunciation.

ORGANIZATIONAL INSTALLATION

Analysis and Inventory of sound material

A *The sound material itself (sound-mimic reflex)*
B *Time structure of a sound of speech*
C *The character of occurrence of a sound*
D *Timbres*
E *Elements and forms of movement of a sound (rhythm)*
F *Techniques and methods of work*
G *The analysis of excitement (connection of excitement with sound)*

ORGANIZATIONAL TRAINING

A *Sound-mimic reflex*
B *Knowledge of elements*
C *Knowledge of principles of combination of elements*

PRECONDITIONS:

1 *Division of all sound material into elements*
2 *Occurrence of a sound (physical) from fluctuation of vocal chords*
3 *Distribution of a sound and its conductors*
4 *Noises – result of non-periodic fluctuations*
5 *Sounds – result of periodic fluctuations*

I SOUND – *mimic reflex. Some muscular sensations. The sound is not heard, but formed. Practice: independent translation of muscular sensation into a body: A O U I E ...*

II FORCE – *Result of fluctuations of sounding body (distance). Practice: estimation of the amount of force according to digital table from 1 to 10 (minimum 1, maximum 10); Contrast of force. Studies – general training (sound gymnastics). Studies – individual tasks (the amount of force, difference of force).*

III REGISTERS – *Three normal registers – chest, middle, head. Practice: consecutive transition from one register to another: contrast of registers; Studies – training and general; Studies – tasks (free transition and change of registers). Free composition – a combination of elements – registers and forces.*

IV THE BREAK (GAP) – *The break (gap) – a difference in the joining of material on the occurrence of a sound. Distinction of elements of the break (gap) (impact, pressing, impact-press). Practice: technical perfection of separate elements of the break. Studies: a pressing sound with translation into the impact; the amount of force, registers and break, duration; a difference in the gap. Combination – a free composition on all elements. Division of parts, the culmination, item. Monitoring of all elements, nuances.*

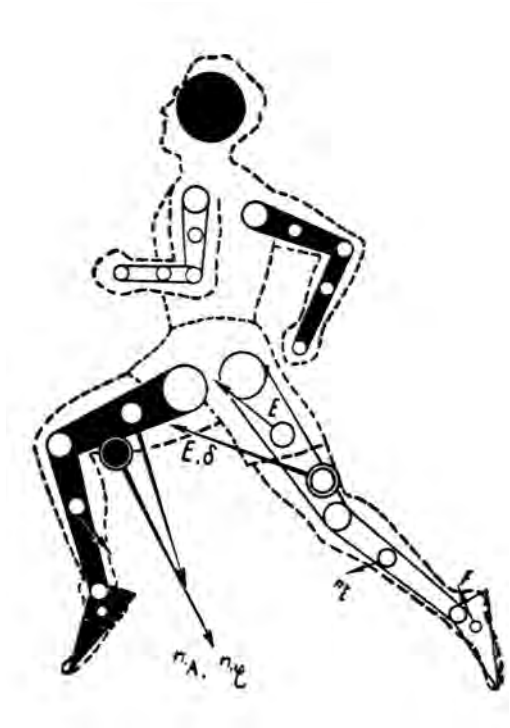
CONCLUSION – *a sound monologue – 4 parts. The amount of all sound material on all elements. The score of the monologue.*

EXCITEMENT – *Physiological process*

A *The character of the heartbeat*
B *The character of breathing*

Difference of excitement – a difference in the rhythm of the breath and the rhythm of the heartbeat.

15 Bogatirov, A. Program on Sound at Moscow Projectionist Theatre. 1927-28. State Tretyakov Gallery archive. Trans. AS. Quoted in: Pchelkina, L. *The Art and Experimental Works of Solomon Nikritin 1910-30*. Unpublished dissertation. The State Institute for Art Studies, Moscow.



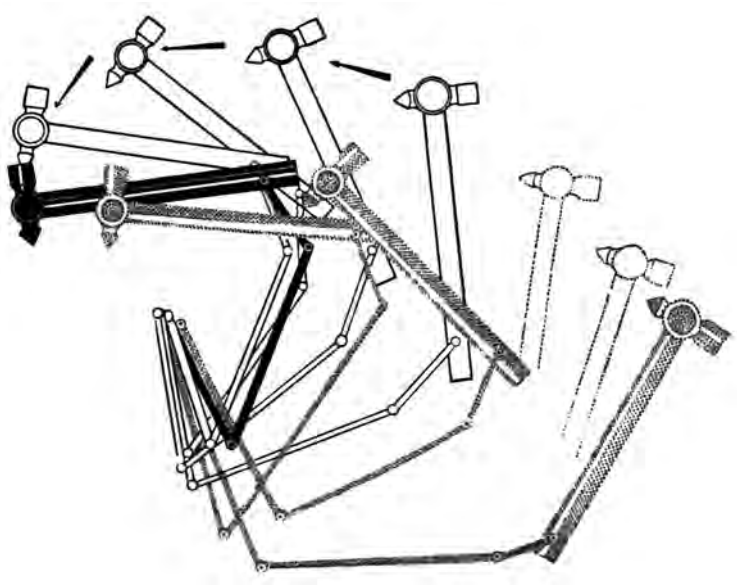


fig 4.14 The phase of running. Diagram showing the effort in the centres of gravity relating to foot parts. Research on human movement, CNIIFK, 1934-39, featured in Nikolai Bernstein's book *O postroenii dvizheniy* (About the building of motion), Moscow, 1948.

fig 4.15 Consecutive positions of an arm and hammer in motion. One of the first images produced by Nikolai Bernstein at Gastev's Central Institute of Labour in 1923. Reproduced in Nikolai Bernstein, *O postroenii dvizheniy* (About the building of motion), Moscow, 1948.

MACHINE WORSHIPPERS

No documentation of the Projection Theatre performances is known to have survived. Nevertheless, in one of René Fülöp-Miller's articles, published in Germany in 1923 and immediately translated into Russian by Nikritin, we find an ironic but fascinating description of the performances of the new theatrical studios and workshops:

Lately in Russia the machine has become a new idol, greedily devouring new victims again and again. Many times they have tried already to open its mysterious essence; they are now going to subordinate to its laws their own lives and all the productivity of the world.

The worship of the machine in the new Russia carries obvious features of a strictly expressed religious cult. I have clearly noticed it while visiting studios and workshops of the New Artists (the name of the temples where the mysteries of the Machine Worshippers are played). Machine models are mystically rising from the ground along walls. Made with iron, concrete or wood, these are temple statues to the new God – the Machine. The walls are entirely covered with schematic drawings, representing in various positions and longitudinal sections the physiognomy and torso of the god. The constructional drawings, in their turn, bear exclusive appearances of icons, whether it be 'a sacred longitudinal section of the machine' or 'the sacred generator of a dynamo'. Everything here asserts attraction to the uniform, to the highest light of truth, conducting all laws of the world.

Amen.

The people entering these halls reminded me of pensive members of a sect; with their sight, gait and conversations they looked like the proponents of some sacred cult. Even their dress and their hairstyles were suggestive of the ritualistic appearance of a sect. They stood for hours in this divine temple, all overflowing with surprise at these icons of the beloved deity, in front of the innumerable iron and wooden constructions on walls. Once I was fortunate to observe it in action, having visited the notorious 'Machine Dances' on Mondays at the well-known Forregger's Theatre studios, where the highest worship of the God of Machines was expressed through dance. All of the participants were trying hard to represent mechanical movement by dance. The harmonious bodies of the cult's clerics, both men and girls, in movements exclusively reminiscent of machines, left me with a very strange impression. For the first time, here I also heard the new holy church music of the Machine Worshippers. The voice of the Machine God was powerfully and loudly distributed. It was followed by the polyphony of gentle dialects of choruses of thousands of wheels, shafts, nuts and driving belts. An improbable crackle, noise, whistling and groaning – all the noises of the world merged in a polyphonic tangled fugue. This music was growing and growing, bursting in the end with an unlikely, ear-splitting chord, eulogizing the infinite God of Machine Spheres. The Noise Orchestra is the name of this new music, this divine messenger of the new gospel. Its purpose is to prepare our collective soul for the perception of sacred revelation.

I was even more impressed by a performance of this newest church music held in the festive hall of the Moscow Trade Union Palace. The celebration I am talking about took place in honour of the official divine service of the so-called 'Engineerists'.[16] *The first public divine service of these 'machine worshippers' began with a noise orchestra composed of a crowd of motors, turbines, sirens, hooters and similar instruments of din; the choir master stood on a balustrade and 'conducted' the din with the aid of complicated signalling apparatus. After the noise overture had raged long enough to deafen the audience completely, the real passion play began.*

A few minutes later my own consciousness had been finally muffled, or perhaps it is better to say, I totally lost any ability to think. Certainly, my present condition of passivity entirely subjected me to the authority of the drama that was now being played out in the hall. Of course, it had no wings or stage and was performed in the hall in the midst of the crowd, similar to the ancient religious mystery plays. Priests appeared in the hall even prior to the beginning of the Noise Music. All of them entered with a special machine-like gait. At last the Noise Orchestra stopped playing, responding to the voices of the priests crying out, absolutely mechanically, a number of syllables, which are a real riddle for the uninitiated. It was not dissimilar to the singing of a church soprano after the organ prelude. Then the action began. Certainly, it would be necessary to master all the newest language to be able to express the various machine-like movements of the actors. Reckless gymnastics were zealously performed with choppy movements mechanized as far as possible, on all kinds of gymnastic apparatus, under, in, on, between, before, and beside the various machine structures.

Between the beginning and the end there was a noticeable increase of dramatic action; I even noted some tragic and excited movements in the reciprocal postures of some of the actors. It appeared that quite uncommon things were happening in this gestural language, to be understood only by the initiated. One of the Machine Worshippers, sitting next to me, immediately fell into a state of supreme excitement and emotion; he assured me that this was a passion play that represented the sacrifice of the lower individual man on the altar of the mechanized and soulless collectivity.

I think, that having seen and having heard all of the aforesaid, I have sufficiently familiarized myself with this mystical school of the Machine Worshippers, with their ceremonies and temple holidays. I would just like to know what actually this new adored God demands from us. Who really is it? Why is it celebrated in such a noisy and repetitious way?[17]

16 By 'Engineerists' the author means Projection Theatre, which presented a show in the hall of the Moscow Trade Union Palace in 1923.

17 Fülöp-Miller, R. 'Die Machinenanbeter'. *Vossische Zeitung*, Berlin, 13 October 1923, #485, p.3. Russian trans. by S. Nikritin. Quoted in Pchelkina, L. *The Art and Experimental Works of Solomon Nikritin 1910-30*. Unpublished dissertation. The State Institute for Art Studies, Moscow. English trans. by A. Smirnov.

5. THE REVOLUTIONARY SOUND MACHINES

NOISE ORCHESTRA

From 1921 to 1923 in Moscow, the performances of the Projection Theatre and the theatrical studio MASTFOR (Forregger Workshops) conducted by Nikolai Forregger, as well as the sound experiments undertaken by the First Workers' Theatre of Proletkult conducted by Sergei Eisenstein, provoked a fashion for Noise Music and Noise Orchestras. Despite the obvious resemblance to the Art of Noise of the Italian Futurists and the related noise instruments 'Intonarumori', the Russian trend of Noise Music had a different aesthetical, philosophical and ideological basis and Russian noise musicians appear to have worked without reference to their Italian predecessors.

In fact there were two parallel trends within the Noise Orchestra at the beginning of its existence. One of them was based on deep theoretical and philosophical research under development at experimental theatre groups like the Projection Theatre. It was hidden behind theatre walls and was quite 'secretive', conceptually predating the most radical avant-garde ideas of the 1960s and 70s. Another mass trend was the hobby of building self-made musical instruments for personal amusement, mass demonstrations and holidays. It was a sort of 1920s DIY (Do It Yourself — *Sdelai Sam* in Russian) and was a consequence of both the lack of available musical instruments at the time and the surge of interest among passionate amateur artists and musicians that had been initiated and encouraged by Proletkult. While this latter trend was aesthetically close to urban folklore, both the trends for musical inventions and avant-garde theatre were inspired by the idea of 'transformation' by means of making art out of the chaos of life and extreme daily occurrences, and they gradually grew to become a mass amateur youth movement of noise makers called the 'shumoviks'.

Many inventors patented new sound machines devised especially for the performance of Noise Music. As René Fülöp-Miller noted in 1926:

The same idea also governed the true proletarian music: it, too, emphasized the rhythms which corresponded to the universal and impersonal elements of humanity. The new music had to embrace all the noises of the mechanical age, the rhythm of the machine, the din of the great city and of the factory, the whirring of driving-belts, the clattering of motors, and the shrill notes of motor-horns.

Therefore, the Bolshevists very soon proceeded to construct special noise instruments, to form noise orchestras, and to give the public a 'real new music' instead of the usual old bourgeois individualistic 'patchwork', and in this way to prepare the collective soul for the revelation of the 'holiest' experience. They imitated all conceivable sounds from industry and technology and united them in peculiar fugues, in which a whole world of noise deafened the ear. In increasingly extended forms the new

'machine music' made itself felt, and soon noise symphonies, noise operas, and noise festive performances were composed.[1]

One example of this trend was *Noiserhythmusic* (Shumrhithmuzika) composed by Arseny Avraamov in November 1923 for the piece by Sergei Tretjakov, *Do you hear, Moscow?*, performed by the First Workers' Theatre of Moscow Proletkult, staged by Sergei Eisenstein. Avraamov explains: 'I am writing the most amusing score for the interlude between the second and third parts of *Do you hear, Moscow?* During the construction of a speaker's platform for the third part: "Noiserhythmusic" of carpenter's tools: two files, a manual saw and a mechanical one, a grinding wheel, axes, hammers, sledge hammers, logs, nails, planes, chains and so forth will sound. At the same time there will be no embellishments — just the original work copied rhythmically and harmoniously.'[2]

Meanwhile the term 'shumovik' became common in theatres and a few years later in radio studios and film factories. It was synonymous with the role of sound designer. Perhaps the most influential *shumovik* in the 1920s was the MKhAT actor Vladimir Popov (1889-1968), who was fascinated by the sound design of theatrical performances, which in the mid 1920s was his favourite hobby.■ During his work at MKhAT-2[3] in 1924-36 he established a sound studio and by the late 1920s became a leading expert on sound design. Later he taught a course on sound design at the School-studio of MKhAT and wrote a textbook. In 1949 he was awarded the Stalin Prize for unique achievements in sound design. With an improbable ingenuity he created sound effects offstage: a thunderstorm and wind, rain and the singing of birds, a thud of hoofs and the roar of a crowd■ (see **figs 5.3**, **6.4**, **6.6-7**, **6.9**, **6.15-16**). There was no electronic equipment at that time, and all noises were created by *shumoviks* supervised by Popov. Among his numerous inventions were the special instruments of his Noise Orchestra — the Ritmokombinator (Rhythm-combiner), the Neptune, the Train, the Steps, the Crash, Resonators, the Wind, the Tractor, the Plane, etc.

fig 5.1

figs →

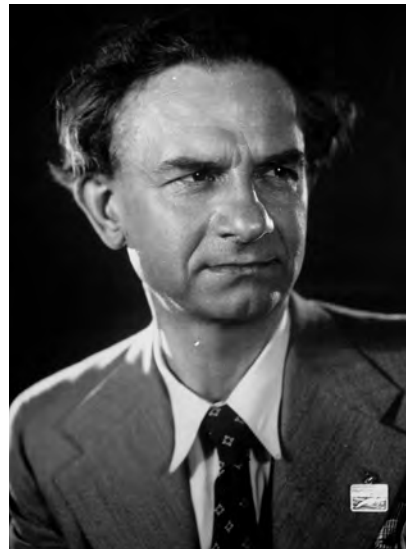
TALKING MACHINES

There were two main agendas that crossed paths in the development of new sound machines in the 1920s: to play and compose with any sounds at will and to synthesize speech and singing. Quite often both were combined in a single device or method. Because of a lack of information and knowledge some proposals were nothing more than the repetition of old and well-known ideas. In most cases there is no information about the prototypes that were built. Nevertheless, many inventors patented new sound machines. Some devices that were based on electro-optical, electro-mechanical and other new electronic technologies were ahead of their time by decades.

1 Fülöp-Miller, R. *The Mind and Face of Bolshevism.* Harper & Row, New York 1962, pp.183-4.

2 Letter to Rebeka Zhiv (night of 13-14 November 1923). R. I. Mikhailova-Mikulinskaya archive. Quoted in S. J. Rumjantsev. *The Book of Silence. Sound image of a city.* The State Institute of Art Criticism, St. Petersburg, 2003, p.70. Trans. AS.

3 MKhAT-2 is the Second Studio of Moscow Art Theatre directed by Mikhail Chehov. It was founded in 1924 on the basis of the First Studio of MKhAT, established in 1912. In 1936 MKhAT-2 was closed.



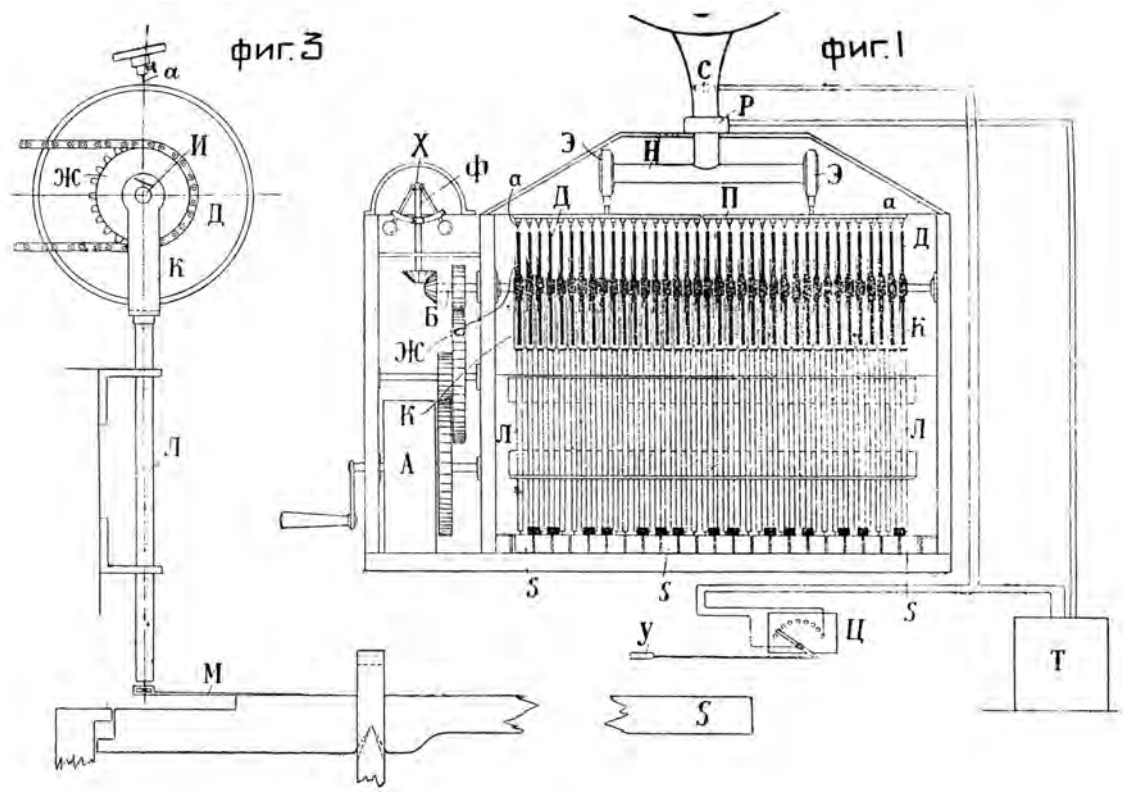
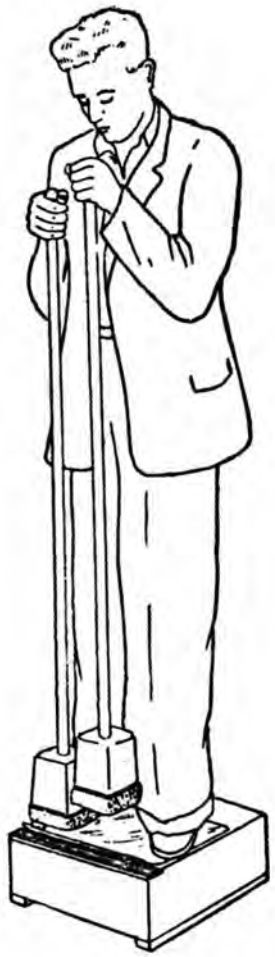
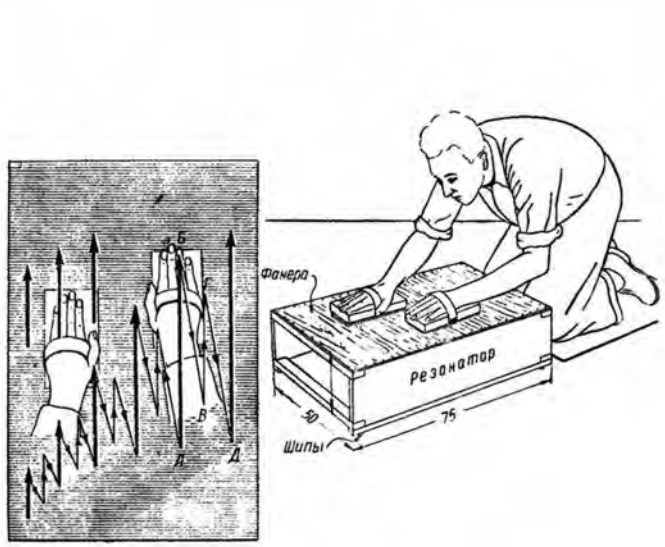
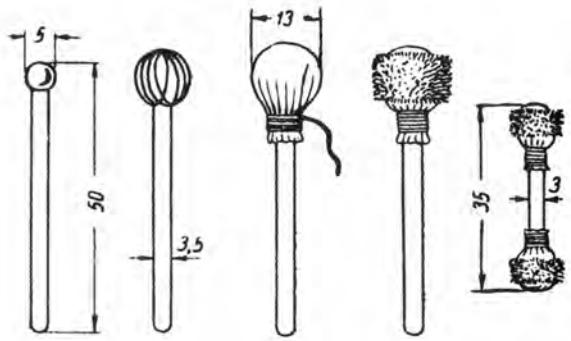


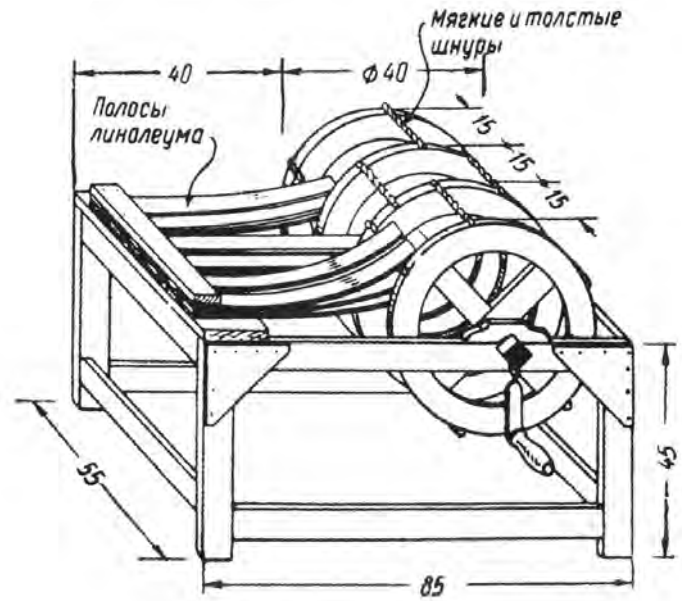
fig 5.1 Vladimir Popov. 1940s. MKhAT museum, Moscow. Courtesy of Konstantin Dudakov.

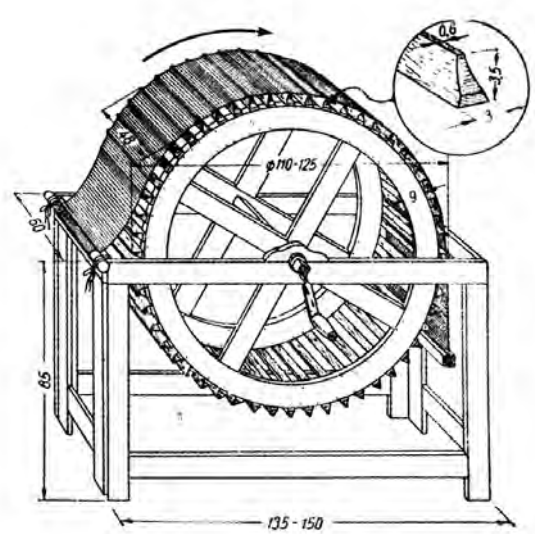
fig 5.2 L.E. Shapovalov. 1929. The Keyboard Musical Instrument. TCA.











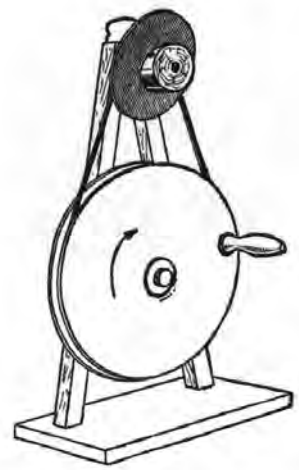


fig 5.3 Various noise tools created by Vladimir Popov. Vladimir Popov. *Iskusstvo*, Moscow, 1961, p.33. Courtesy of Konstantin Dudakov.

The 'Keyboard Musical Instrument'[4] patented in 1929 by inventor Shapovalov, was similar to the Mellotron, developed in Birmingham,
fig 5.2 UK, and which became popular in the 1970s.■ It was intended for reproduction of vocal sounds and musical instruments by means of the musical keyboard switching prerecorded sounds on and off. Unlike the Mellotron, based on prerecorded loops of magnetic tapes, the proposed instrument was equipped with a set of gramophone records activated by means of a musical keyboard.

The 'Talking Machine',[5] invented in 1929 by M. Gribkov was based on a similar principle: it incorporated a set of gramophone records with prerecorded sounds of speech, related to the alphabet, activated by a special optical image recognition system that recognized the graphical shapes of the alphabet to automatically read written text and to reproduce coherent
fig 5.4 speech.■ According to the proposal:

The talking machine is intended for the reproduction of sounds, corresponding to alphabet letters, under the influence of light images of letters from the text projected in a consecutive order by the optical system on corresponding selenic elements. The system consists of:

a) the rotating disk, the lateral surface of which contains grooves having the shape of external contours of various letters of the alphabet, filled with selenium or a similar substance which electric conductivity changes on illumination, and supplied with conductors for connection of the power supply;

b) an optical system, intended for the projection of images of letters of text over the selenic elements on the lateral surface of the disk, appearing consequently during disk rotation;

c) an apparatus for the reproduction of sounds corresponding to various letters of the alphabet, consisting of a rotating shaft 1 with the round plates put on it having gramophone-like grooves with pre-recorded sounds related to separate letters, from a number of needles 3, equal to the number of these letters, the relevant specified plates.[6]

Perhaps the most advanced proto-sampler and speech synthesizer was proposed in 1925 by D. Tambovtsev — the inventor who in the early 1920s patented numerous 'multimedia' devices and prototypes of the modern TV, such as a 'device serving for the simultaneous recording on the same film of sounds,
fig 5.5 colours and stereoscopy of moving subjects'.[7] ■

According to GIMN correspondence the proposal was positively reviewed by the acoustician and mathematician Sergei Rzhevkin. It was a 'mechanical keyboard instrument for the reproduction of speech, singing

4 Shapovalov, L.E. 'Klavishniy muzikalniy instrument' (Keyboard musical instrument). Patent No. 14 779, filed 15.03.1929.

5 Gribkov, M. 'Govoriashaya mashina' (The Talking Machine). Copyright Certificate No. 59 646, filed 4.12.1929.

6 Gribkov, M. 'Govoriashaya mashina' (The Talking Machine). Copyright Certificate No. 59 646, filed 4.12.1929.

7 Device to provide a simultaneous recording on the same film of sounds, colours and stereoscopy of moving objects. Patent No. 1084 of D. G. Tambovtsev, filed 9.02.1921 (application Ser. No. 74350).

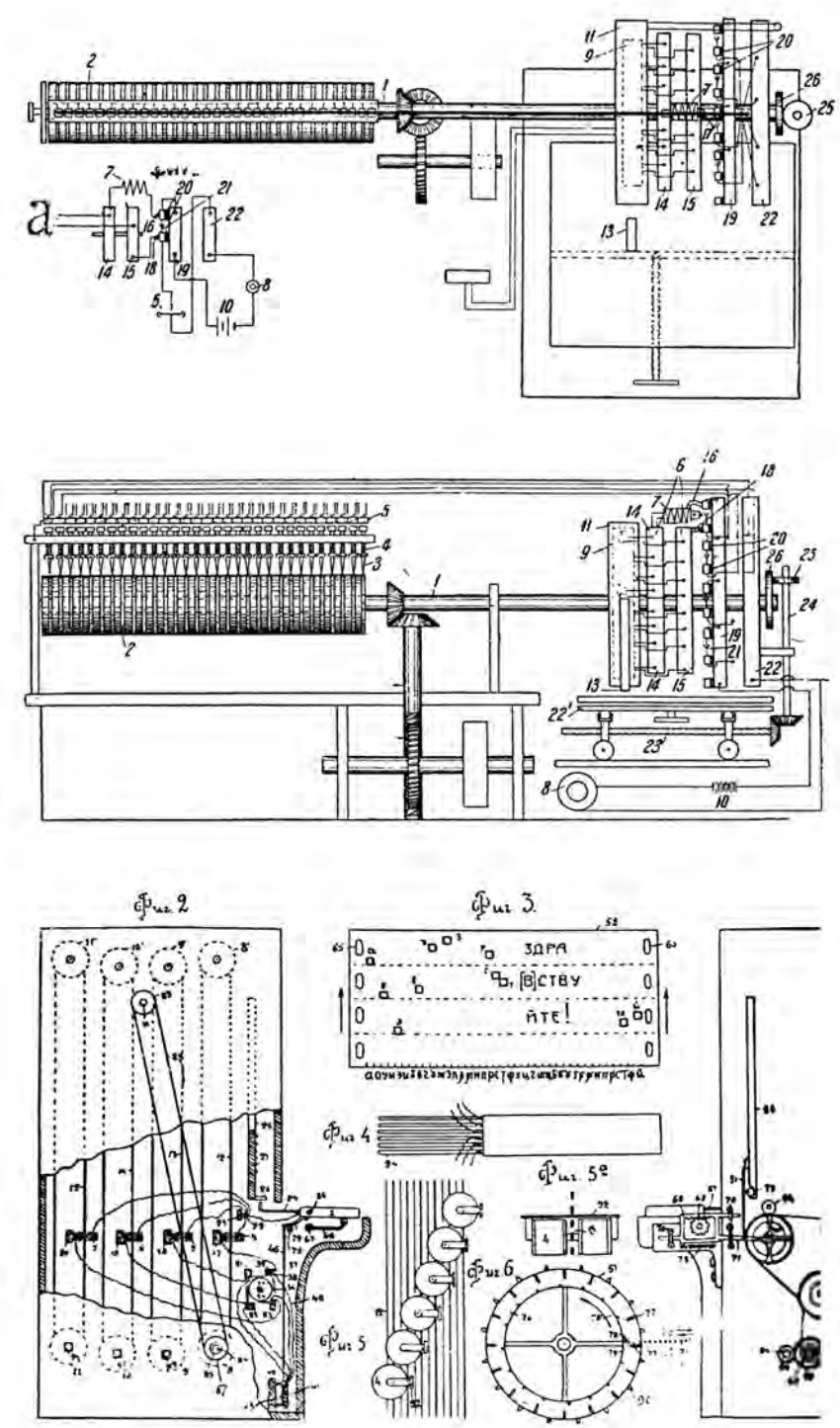


fig 5.4 (Top two diagrams) M. Gribkov. 1929. Talking Machine. TCA.

fig 5.5 D. Tambovtsev. 1925. Mechanical keyboard instrument for the reproduction of speech, singing and various sounds. TCA.

and various sounds',[8] comprising a system of infinite loops of steel tapes with recorded sounds, movable against the poles of electromagnets, working as magnetic heads. It was a kind of proto-sampler, very similar to the aforementioned Mellotron. In the second version of the instrument, patented in 1929, the sound was prerecorded in the soundtracks of infinite loops of cinema films. The instrument was also intended for the production of artificial speech and singing: each key of the keyboard of the instrument corresponds to six tapes, with each corresponding to the six vowels of the Russian language, and with the same number of electromagnets (magnetic heads). Each of these tapes is prerecorded with one particular vowel having a pitch that corresponds to the number of the key on the keyboard, whereas other tapes of the system — having no keys corresponding to them — are prerecorded with consonants or pitchless noises. To minimize the number of steel tapes and magnetic heads, the Russian vowels were divided into two groups, related to simple and complex vowels. These could then be reproduced by means of preprogrammed sequences of softened consonants combined with the related simple vowels or sequenced with a nonsyllabic й at the beginning of words. At the same time Tambovtsev suggested recording all twenty consonants of the Russian alphabet plus twelve of them softened to synthesize complex vowels.

The instrument is capable of realizing a kind of 'concatenative synthesis' [9] to reproduce speech and singing as well as any other complex sounds. It incorporates a special 'sequencer' — a program mechanism based on punched tape that is able to play preprogrammed sequences of speech phonemes, forming words and phrases. A special pressure-sensitive musical keyboard controls the pitch and volume of sounds, permitting the imitation of singing.

Curiously, according to NIMI correspondence an almost identical instrument was proposed once again by the inventor Milovidov in 1940.[10] In fact the principle of concatenative synthesis, based on numerous prerecorded sound segments, was very popular among amateur inventors and had been proposed many times by different authors during the 1930s and 40s.

VARIOUS SOUND MACHINES

In 1929 J.A. Pakhuchi patented an 'Electro-Musical Device' [11] intended
fig 5.7 to provide an electro-musical instrument primarily for the noise orchestras.■ The device worked by means of the application of a buzzer and a pedal rheostat for changing the intensity of a sound, characterized by gear rod H with handle M to influence a cogwheel on the contact screw of a buzzer with the purpose of changing the sound of the latter. In 1926 inventor I. Sergeev patented the 'Electro-Optical Musical Instrument',[12] which was very similar to the
fig 5.6 Rhythmicon, built by Leon Theremin in 1931 in the US.■ It was a sort of electro-optical sound synthesizer, incorporating a kind of sequencer to program graphical scores, based on complicated rhythms and harmonies.[13]

In 1929 Andrey Mashkovich proposed 'a method of transposing sounds, recorded on film, to any key' [14] and one year later he patented a
fig 5.8 'device to produce sound effects'.[15] ■ His invention relates to other devices for the production of sound effects to change the character of sounds as desired, for example, when shooting sound films or broadcasts. The aim of this invention was to produce sound effects through the utilization of a long pipe, supplied by a megaphone or a loud-speaker **a**, and with the apertures located at different points with built-in microphones, **b**, **g** and **d** for the reproduction of a greater or smaller number of echoes and related feedbacks in addition to the basic sound, with the purpose of producing a desirable sound colour.

Some inventors were developing special means by which to increase the influence of propaganda shows on the audience, the effects of which were fading rapidly in the early 1930s as a result of familiarity with the growing bureaucratic regime. N.M. Varzin-Riazhsky patented in 1934 a 'device to accompany gramophone recordings with light pictures' [16] — very much like a multimedia audio-visual tool of today. The goal of the invention was to accompany gramophone records of primarily propaganda speeches, reports and technical lectures from phonograph records with light-based pictures. According to his proposal, many records of this kind that had been released did not fulfil their purpose as they were in need of a visual support. Likewise, it was envisaged that for the arts, whole cycles of records could be accompanied by light images of emotional character. In 1934 N.M. Molodsov invented a 'device for sound on film reproduction, intended to create the illusion of spatial movement of sounding objects by reproducing sound by
fig 5.9 means of sound film'.[17] ■

What made this different from already existing technologies was the use of a four-channel quadraphonic system instead of a standard mono one. To control the localization of virtual sound sources photo-resistors **S+x**, **S-x**, **S+y**, **S-y** are connected into the electrical circuit, connecting loudspeakers to amplifiers in such a way that photo-resistors are shone by means of light coming from the lamp through the film with the recorded tracks to control related volumes of sound, forming the illusion of movement of sound sources in between four loudspeakers.

Among the most characteristic sound sources of the early 1920s — which might perhaps be considered as a substitute for the former 'bourgeois' church bells — were the factory sirens. Without a doubt, the most useful of these for the construction of new sound machines were locomotive whistles.

8 Tambovtsev, D.G. 'Klaviaturniy mehanicheskiy instrument dlia vosproizvedenia zvukov I rechi' (Mechanical keyboard instrument for reproduction of speech, singing and various sounds). Patent No. 6309, filed 9.05.1925.

9 Concatenative synthesis is based on stringing together segments of recorded sound.

10 Reply of the reviewer I. Simonov to the inventor comrade Milovidov 5.09.1940. GIMN/NIMI archive at the Theremin Centre Collection.

11 Patent No. 19 675, filed 26.12.1929.

12 Patent No. 12 625, applied for in 1926.

13 In fact this machine is also reminiscent of the Mechanical Orchestra described by Evgeny Sholpo in 1917-18 in his essay 'The Enemy of Music'.

14 Patent No. 15 234, filed 10.09.1929 (Application Ser. No. 54 351).

15 Copyright Certificate No. 31 642, filed 24.10.1930 (Application Ser. No. 77 894).

16 Copyright Certificate No. 41 209, filed 25.03.1934.

17 Copyright Certificate No. 49 350, filed 8.06.1934 (Application Ser. No. 148 672).

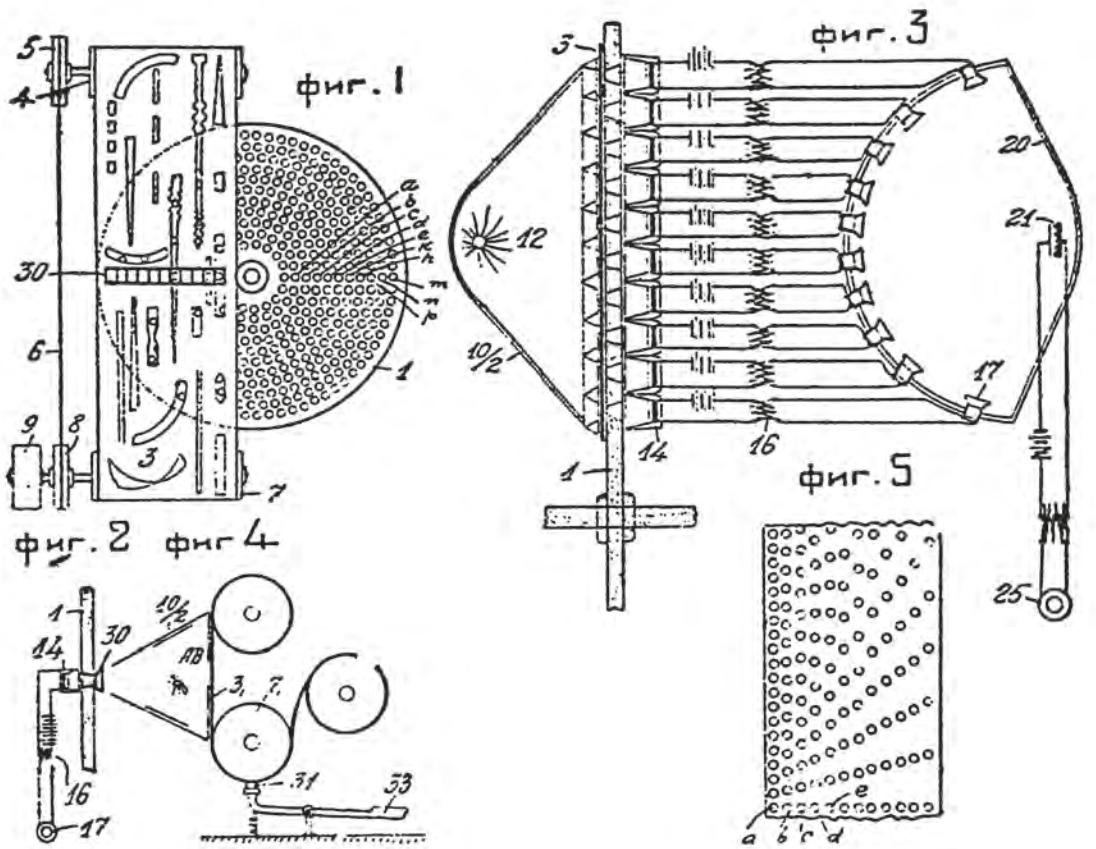


fig 5.6 I. Sergeev. 1929. An Electro-Optical Musical Instrument. TCA.

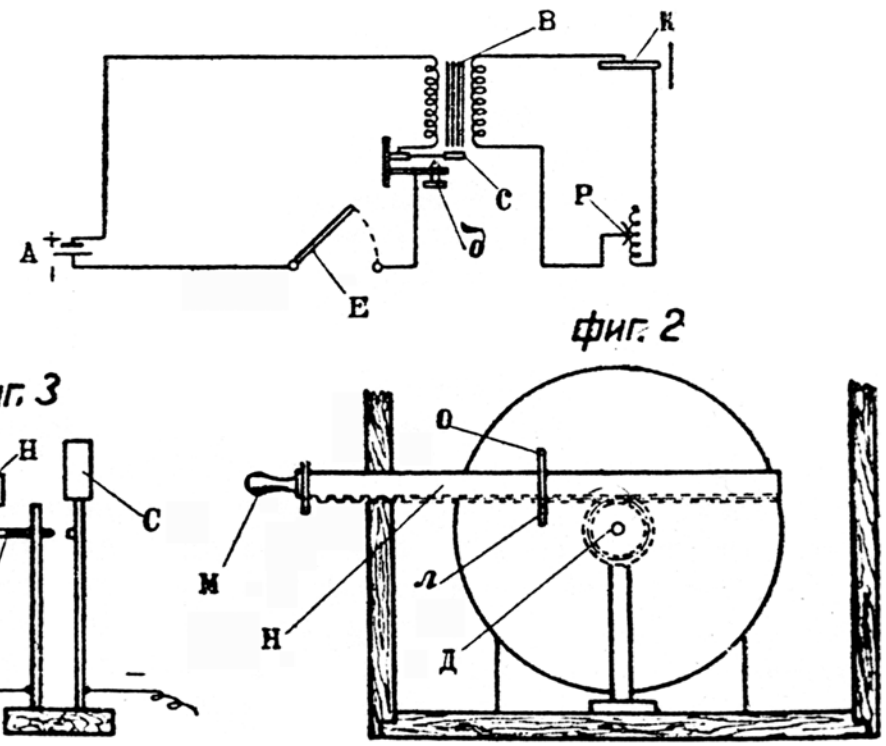
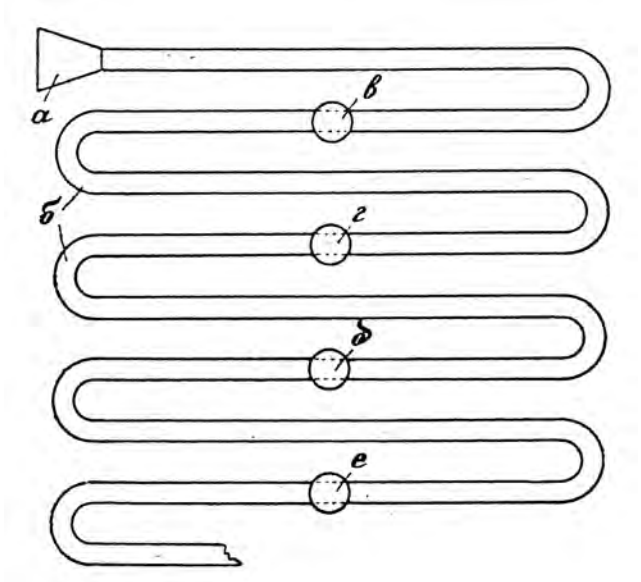


fig 5.7 A. Pakhuchi. 1929. An Electro-Musical Device. TCA.



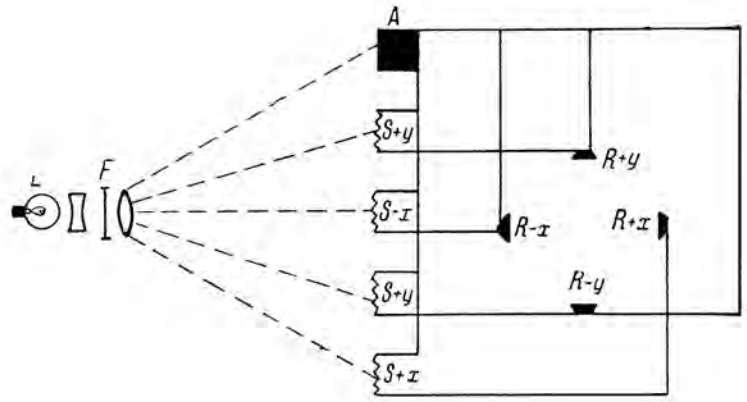


fig 5.8 Andrey Mashkovich. 1929. Device to produce sound effects. TCA.

fig 5.9 N. M. Molodsov. 1934. Device for sound on film reproduction, intended to create the illusion of spatial movement of sounding objects by reproducing sound by means of sound film. TCA.

Among the most futuristic projects to have been based on them, it is worth mentioning the proposal of the painter and MKhAT-1 actor Alexander Geirot:

The actor from the First Studio of Moscow Academic Theatre A. A. Geirot has developed a project with the huge organ, which, with sonority reaching extraordinary power, can extend to several versts[18] *around.*

The organ is mounted on one of the large factories and is put into action by use of steam energy from boilers onto which a special system of bypass pipes is constructed out of factory whistles, hooters and sirens mounted at the ends of the pipes, tuned for the corresponding power and tonality. An electric keyboard can be set up in the centre of the city.

The author of the project names the invention 'The Labour Organ' and believes that the project can be realized easily, and even during a fuel crisis concerts of the 'Labour Organ', arranged on proletarian holidays, will hardly be burdensome.

Speaking about the project, A. A. Geirot paints a surprising picture when at the end of the daytime, for processions, meetings and evening mass shows, the city as it calms down is still filled with the hitherto unprecedented sounds of the organ as though flowing from the black space of the night and a dome of stars. The experience should turn out to be unforgettable.[19]

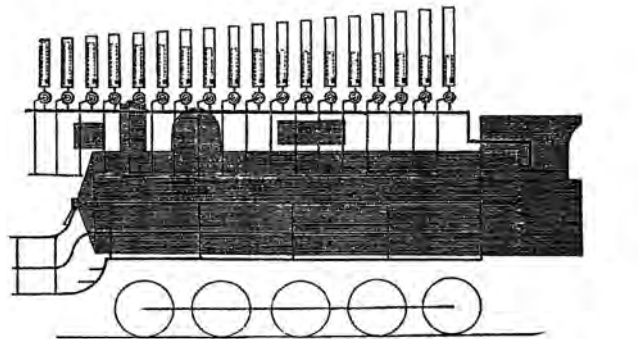


fig 5.10 Arseny Avraamov. 1923. The Steam Organ. *Gorn magazine*, 1923, vol.9. TCA.

In 1927 inventors M.S. Snisarenko and S.J. Livshits patented 'The Alarm Sound Device'.[20] Based on a special pneumatic siren it was intended to 'shout' short phrases like 'danger!', 'fire!', etc. Meanwhile composer Arseny Avraamov proposed the 'Steam Organ' as a mobile instrument with which to perform his *Symphony of Sirens*, and incorporated numerous locomotive whistles specially tuned in his 'Ultrachromatic' scale. The electrified musical keyboard that controlled the electric valves that in turn activated the whistles was to be mounted in the cabin of the locomotive driver.[21]

18 1 versta = 1066.80 m.

19 *Zhizn Iskusstva* (The Life of Art). 1921. #758-760. Quoted in Rumjantsev, S.J. *The Book of Silence. Sound image of a city.* The State Institute of Art Criticism. St.Petersburg, 2003, p.57. Trans. AS.

20 The Alarm Sound Device. Patent No. 56 46, applied for 16.02.1927.

21 *Gorn magazine,* 1923, vol.9, p.110.

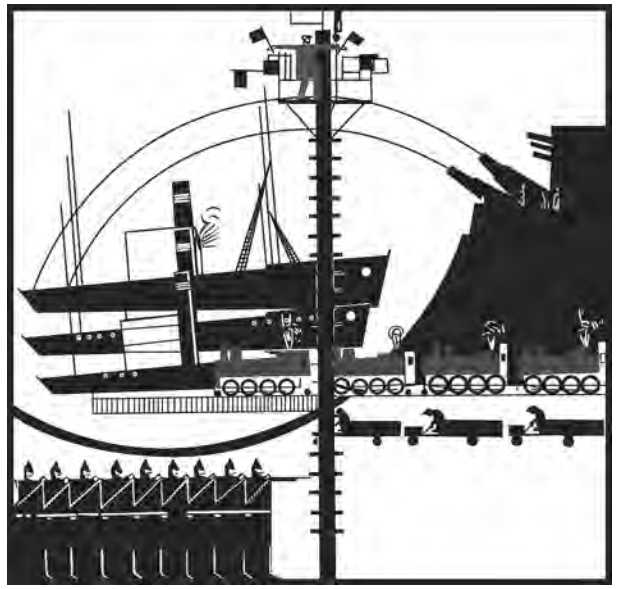


fig 5.11 Illustration of the *Symphony of Sirens* in Baku (1922). Recreation of the original by Ben Javens, 2008. 'Symphony of Sirens', *Gorn magazine*, 1923, vol.9.

THE SYMPHONY OF SIRENS

On 7 November 1922 in the port town of Baku, in celebration of the fifth anniversary of the Revolution, Avraamov, inspired by the poetry of Alexei Gastev, staged his best-known creation: the *Symphony of Sirens*. This epic spectacle featured a cast of choirs, the foghorns of the entire Caspian flotilla, two batteries of artillery guns, a number of infantry regiments including a machine-gun division, hydroplanes, and all the town's factory sirens. The conductor, posted on a purpose-built tower, signalled various sound units with coloured flags and field phones.

The second performance took place a year later, on 7 November 1923 in Moscow. According to Avraamov: 'Artillery. Because of the big area of distribution of the factory sirens it is necessary to have at least one heavy gun for signalling purposes with the capacity to shoot with live cartridges (shrapnel is not suitable for this, bursting off in the air is most dangerous and gives a second explosion sound, which can confuse the performers).

'The "big drum" can be provided by the field artillery as well.

'Skilled machine gunners (when shooting with a live cartridge belt) not only simulate a drumbeat, but also beat out complex rhythmic figures.

'A gun shooting with blank cartridges as well as gunfire with frequent packs are good for vivid scenic sounds.'[22]

A central sound-machine called the 'Magistral' contained fifty steam whistles controlled by twenty-five musicians following 'text-scores'. In the Baku performance it was mounted on the torpedo boat Dostoyni; a year later in Moscow it was presented in the yard of the central thermal power station (MOGES).

22 *Gorn magazine*, 1923, vol.9, p.112.

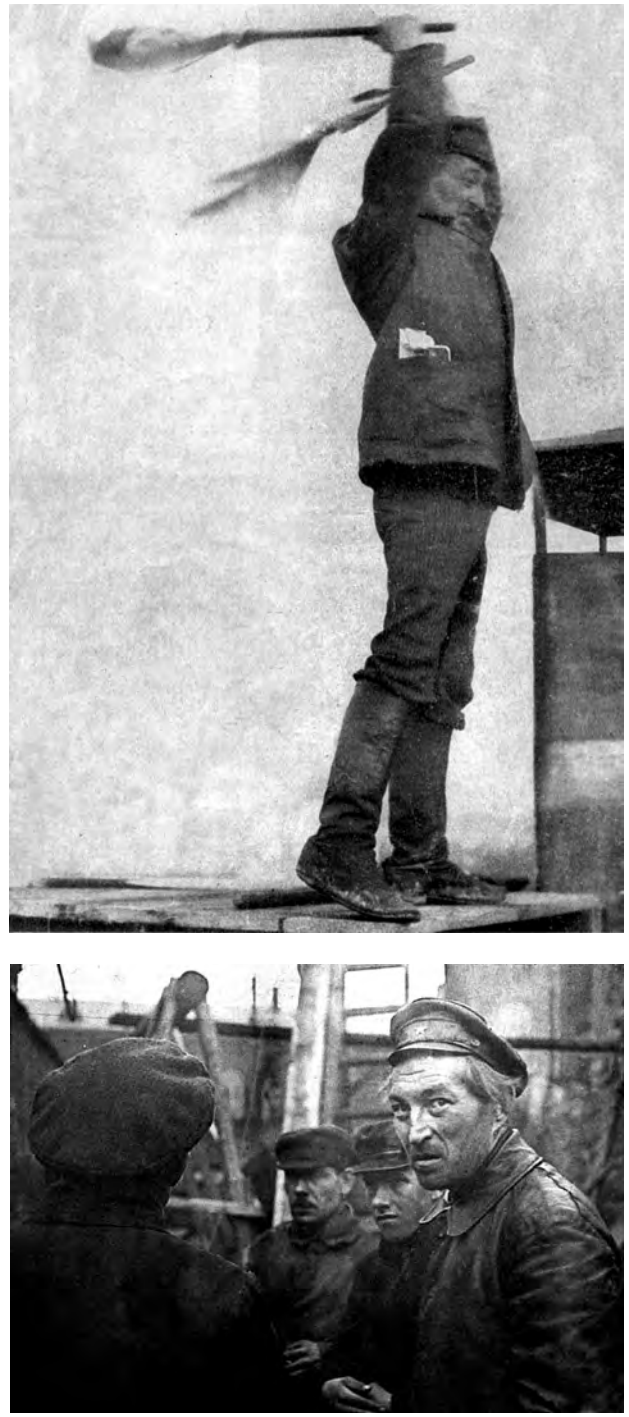
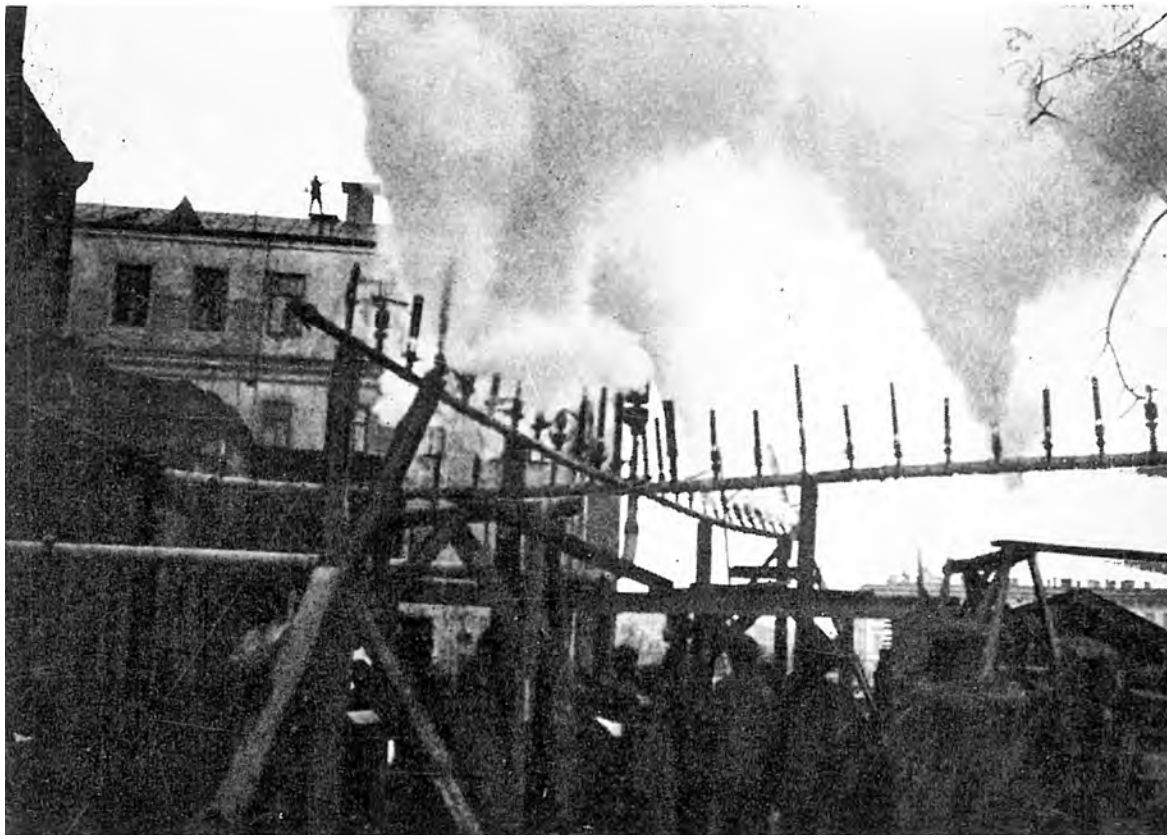
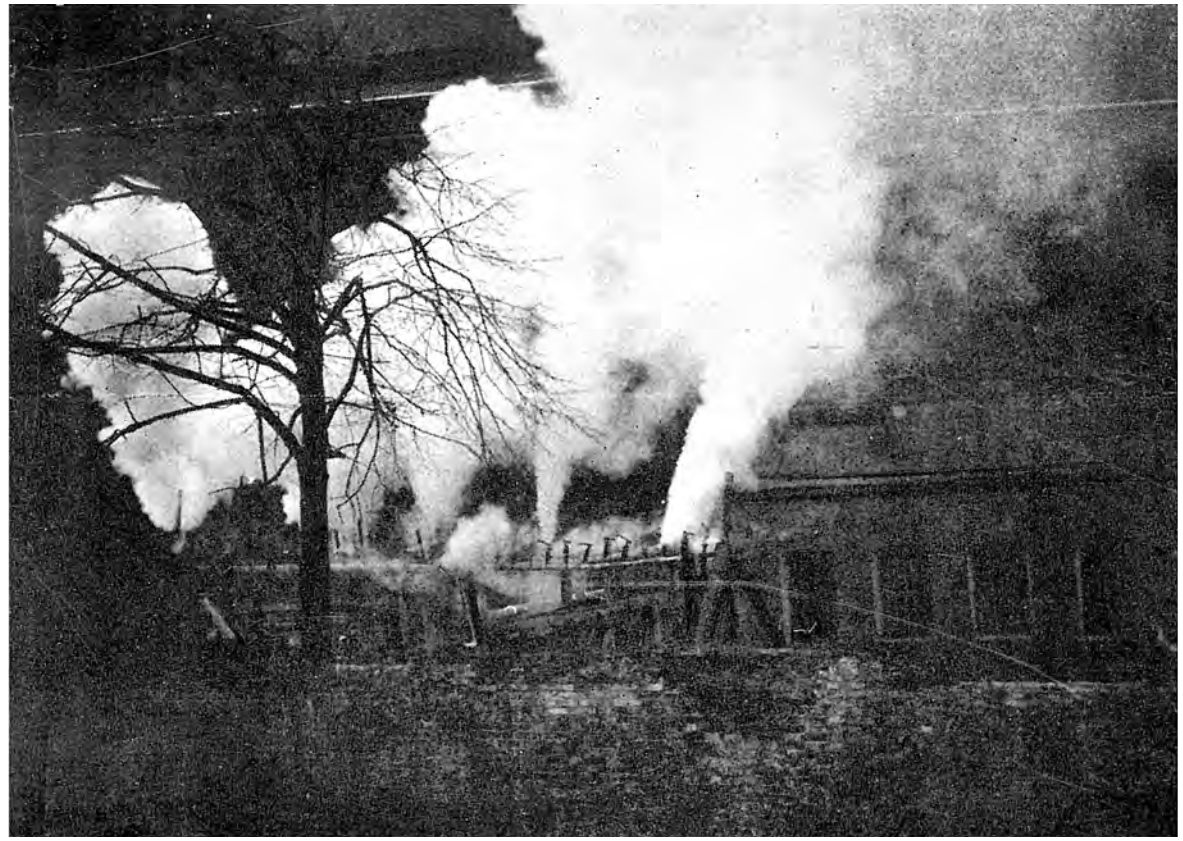


fig 5.12 Arseny Avraamov conducting the *Symphony of Sirens*, Moscow, 7.11.1923. René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna, 1926.

fig 5.13 Arseny Avraamov before the performance of the *Symphony of Sirens*. Moscow, 7.11.1923. M. Glinka Museum for Musical Culture, Moscow.





figs 5.14-15 The *Symphony of Sirens*. Performance in Moscow, 7.11.1923. The steam 'Magistral' and the conductor on the roof are visible. René Fülöp-Miller, *Geist Und Gesicht Des Bolschewismus*. Amalthea-Verlag, Vienna 1926.

While it incorporated *The Internationale*, *The Marseillaise* and especially composed music, the *Symphony* had no fixed content and was to be reinterpreted for particular cities and contexts.

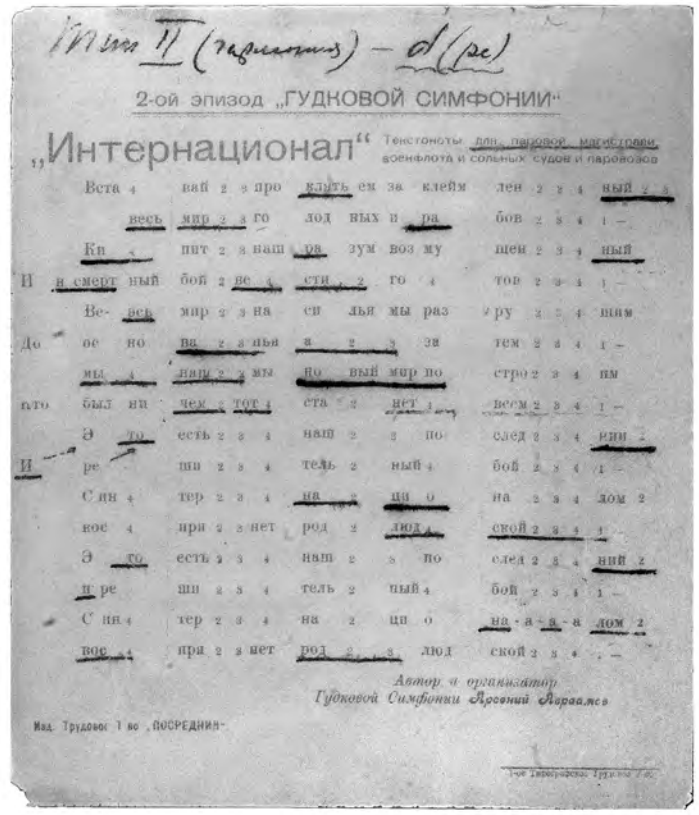
The second performance was not as successful as the first because of the huge area covered by the sirens and artillery leading to enormous distances between the performers. Military divisions didn't have sufficient ammunition, as had been requested by Avraamov. The show also overlapped with a demonstration dedicated to the sixth anniversary of the October Revolution. As Avraamov put it: 'They gave us only twenty-seven heavy gun shots! It is for the big drum! And there were no machine guns at all... only gunfire! And there were two dozen aeroplanes buzzing over Red Square.' [23]

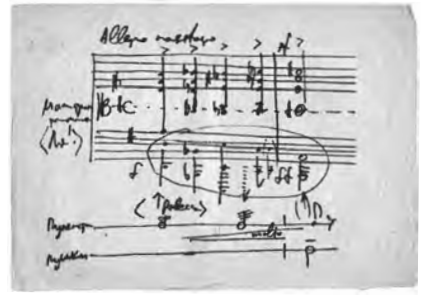
To get a real impression of the performance the GIMN institute applied for an additional night-time show, which was never realized. Somewhat later, in 1923, working on the draft program of GIMN, Avraamov proposed a project named 'Topographical Acoustics'. He suggested building powerful electro-acoustic systems that could be installed on aeroplanes, from which vast areas of land could be covered with sound. He noted in 1927: 'And if the sound of sirens is not powerful and qualitative enough, what could we dream about? Clearly: about the devices of Theremin or Rzhevkin, installed on aeroplanes, flying above Moscow! An Aerosymphony!' [24]

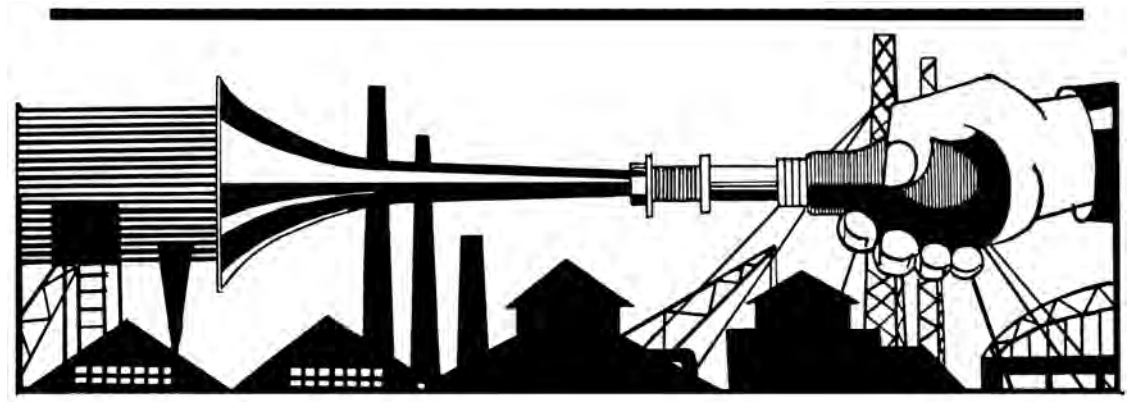
ORDER 06

Asia — all on the note D.
America — a chord above.
Africa in B-flat.
The radio-conductor.
Cyclono-cello — solo.
Play forty towers by a bow.
The orchestra is along the equator.
The symphony is along the parallel 7.
Choruses are along the meridian 6.
Electro-strings — to the terrestrial centre.
Keep a sphere of the Earth in music.
Four seasons.
Sound pianissimo on an orbit four months.
Make four minutes volcano-fortissimo.
Tear off for a week.
Burst volcano-fortissimo crescendo.
Hold on volcano half a year.
Fade out to zero.
Finish the orchestration.

Alexei Gastev, 1921. [25]







23 Avraamov, A. Letter from 11.11.1923. R. I. Mikhailova-Mikulina's personal archive. Trans. AS.

24 Avraamov, A. 'Novaya era muziki' (New Music Era). *Sovetskoje Iskusstvo*, 1925, No.3. Trans. AS.

25 Gastev, A. Order 6. *A Packet of Orders*. Trans. AS.

fig 5.16 'Textonoti' (text-scores). 1923. Each performer had one unique page with specific notes marked. Each could play only two specific notes from the whole set of fifty notes of the 'Steam Whistle Organ'. M. Glinka Museum for Musical Culture, Moscow.

fig 5.17 The first page of the *Symphony of Sirens* score with parts of the 'Magistral', cannons and machine guns. Avraamov ciphers here the names of his wife Olga (aka La - tjnality) and girlfriend Rebeka (notes Re-b-e-c-a). M. Glinka Museum for Musical Culture, Moscow.

fig 5.18 Liubov Popova. Illustration for the magazine *Muzikalnaya Nov'* (Musical Novelty), 1922. Lithograph. Museum for Modern Arts, Thessaloniki.

fig 6.1 Pavel Tager. Moscow, 1929. TCA.

fig 6.2 Alexander Shorin. Leningrad, 1929. TCA.

6. SOUND vs. IMAGE

SOUND-ON-FILM TECHNOLOGY

The first practical sound-on-film systems were created almost simultaneously in the USSR, USA and Germany. In Soviet Russia Pavel Tager initiated developments in 1926 in Moscow. Just a few months later in 1927, Alexander Shorin started his research in Leningrad. The first experimental sound-on-film programme — several parts from the film *Babi riazanskie* (Women from Riazan) — was demonstrated on 5 October 1929 in Leningrad, in the Sovkino Cinema, specially equipped with Shorin's sound-on-film system.■ A few months later on 5 March 1930 the first sound cinema was opened in Moscow with a demonstration of the so called *Zvukovaya sbornaya programma N1* (Combined Sound Program N1), which included four films, namely a speech by Anatoly Lunacharsky about the significance of cinema, *March* by Sergei Prokofiev from the opera *Love to Three Oranges,* the film *Piatiletka. Plan velikih rabot* (The Plan of Great Works), and the cartoon *Tip-Top* by Abram Room and Grigory Levkoev with music composed by Georgy Rimsky-Korsakov, Nikolai Timofeev, Alexander Tsfasman and Nikolai Malahovsky, and sound design by Arseny Avraamov.

fig 6.3

Unfortunately this program didn't survive, sharing the same fate as many other unique early works by various authors. It would be fair to say that early Soviet sound cinema is both underestimated and under-explored, not least due to the fact that in the early 1930s censorship was more rigorously enforced than before — many films were censored, subjected to repression or simply disappeared. Conversely, the brief period between 1930 and 1934 produced numerous extraordinary discoveries related to the art of sound. There were several reasons for this:

1 *For the first time, artists fascinated by the idea of sound as an art medium had the long-awaited opportunity to edit, process, mix and structure prerecorded audio material combining any sounds at will. The film critic Alexander Andrievsky noted in 1931: 'While abroad the first works related to sound cinema were mainly based on music material, in the USSR we had another trend. The main audio material of the first sound movies was based on noise and various rumblings.'*[1] *Both Vertov and Room studied at the Neurological Institute in Petrograd and positioned themselves as professionals in the physiology of perception. Both envisioned sound cinema primarily through the development of acoustical approaches.*[2]

1 Andrievsky, A. *Postroenie tonfilmi*. Leningrad. GIHL, 1931, s. 21. Trans. AS.

2 Zaharin, D. *Ot zvukovogo landshafta k zvukovomu dizainu. 'Antropologicheskii Forum'* (Forum for Anthropology and Culture) 2009. N11.

2 *In the early sound films the most popular approach was 'the CONTRAPUNTAL METHOD of constructing sound film'* [3] *which led to the creation of self-sufficient soundtracks, and aesthetically was very close to the future Musique Concrète, invented by Pierre Schaeffer in France in 1948.*

3 *Because of the lack of equipment and developed methods to make synchronous recording of sound during the filming, the majority of sound films produced in the early 1930s were shot as silent with soundtracks added later in studios. Being based on the contrapuntal method, these soundtracks became masterpieces of early sound art.*

RADIO THEATRE

On 25 December 1927 the architect Ivan Rerberg finished constructing the building of the Moscow Telegraph, which was announced in 1928 as being a new stage for Radio Theatre. In Leningrad the first Radio Theatre was founded in the building now occupied by the Bonch-Bruevich Institute of Telecommunications. The process of mastering sound recording for the radio was reminiscent of the process of introducing sound into cinema. On 4 September 1929 the State Radio Committee published its order No. 104 in which the new position of sound producer was introduced into the structure of broadcasting companies. The profession of the sound producer had officially been born, and all manner of artistic and technical experiments with sound were made the responsibility of this person and their staff. The experimental Radio Theatre at the Telegraph became the model institution for new studios that were keen to introduce unusual experimental approaches: 'We have a wealth of opportunities to apply sound as a semantic vehicle, i.e. the semantic value of using sound as a carrier of certain emotions etc. Sound in radio art is not just a makeweight alongside words.' [4]

In 1931 the Radio Film factory was founded especially for the preparation of radio broadcasts. These were first recorded on film as soundtracks without imagery. The factory was organized in a similar fashion to a film studio. That same year the first experimental radio works were broadcast.[5] The main expert in sound design was the aforementioned actor from MKhAT-2, Vladimir Popov, who was also hired by the factory as *Shumovik-Constructor*. 'Vladimir Alexandrovich [Popov] was the outstanding master, the artist of theatrical noises or more precisely — sounds, in their every possible combination. He invented an infinite quantity of devices and gadgets by means of which he could solve the most complicated problems of sound design.'[6]

fig 6.3 Alexander Shorins's system during the first public demonstration in 1929. TCA.

3 Eisenstein, S., Alexandrov, G., Pudovkin, V. 'Statement on Sound' (1928), *Eisenstein. Writing 1922-34*. Ed. R. Taylor (London: BFI, Bloomington: Indiana UP, 1994), pp.113-14.

4 Novogrudsky, A. 'Protiv potoka skuki' (Against a Boredom Stream). *Govorit SSSR*, (The USSR Speaks), 1932, N 35-36. S. 4-5. Trans. AS.

5 'Chto takoe radiofilm?' (What is radio film?). *Govorit SSSR*, (The USSR Speaks), 1932, N 22. S. 4.

6 Turbin, V. 'Rezhisser radio- i teleteatra' (The Director of the Radio- and TV-theatre). *Iskusstvo*, Moscow, 1983. Trans. AS.

fig 6.4 Vladimir Popov during a sound recording session. *Smena* magazine, N3-4, 1932, p. 28. AS library.

fig 6.5 Studio sound recording for one of the first sound films *Zhivie dela* (Live Affairs). Moscow, 1929. Krasnogorsk archive. RGAKFD 2-35622.

Perhaps Popov can be considered a pioneer of Russian Soundscape.[7] According to the recollections of his colleagues:

Frequently we needed noises of a modern city for the Theatre of Radio Miniatures. All attempts to make a live recording of street sounds in the centre of Moscow were unsuccessful. Close passing cars sounded similar to tanks, while distant sounds were not caught... Vladimir Alexandrovich [Popov] made a brilliant noise symphony of a city... Sounds of various horns, distant and in the foreground, a squeal of brakes, the clap of closing automobile doors, the rustling of tyres, far-away hooters, alarms and other typical city noise created a well-developed, multi-layered sound panorama of life in a modern city. And in most cases it was achieved by means of devices that had nothing in common in appearance with their corresponding sounds. Vladimir Alexandrovich always remained both the artist and the inventor... It seemed [Popov] collected in shades and details the great variety [of sounds] that exist in nature and that surround us. For instance, he knew precisely how the ripening or already ripened rye rustles in different kinds of wind. I cannot remember a single case in which he could not convey the character of a desired sound.[8]

ORGANIZING SOUND

On 29 February 1930 Avraamov was invited to take part in a discussion at ARRK (The Association of Workers of Revolutionary Cinematography). He had to present his views on the first Soviet experimental sound film *Piatiletka. Plan velikih rabot* (The Plan of Great Works) by Abram Room, in which he was involved as the chief of the composer's brigade. Somewhat earlier in 1929 Room wrote: 'The visual material played for us a secondary, supporting role, being an outline for sound design... each of us had to apply himself to the theory of radio and acoustics.' [9]

The audience was both large and active in the discussion. As a composer and sound designer, Avraamov, a convinced champion of sound synthesis, had to explain his thinking. Because the conference was transcribed in shorthand, we are fortunate to learn the recipe of his sound 'kitchen'. Avraamov explained:

I should also say that I don't see any contradictions at all between music and noise. Most so-called noises that have been used in the film have not been reproduced by means of noise instruments, but rather have been reproduced by musical means by real musical instruments.

The harmonium has played a huge role in this business:

7 A soundscape is a sound or combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. Wikipedia.

8 Turbin, V. 'Rezhisser radio- i teleteatra' (The Director of the Radio- and TV-theatre). *Iskusstvo*, Moscow, 1983. Trans. AS.

9 Room, A. 'Nash opit' (Our experience). *Kino*, 1930, N2, s. 13. Trans. AS.

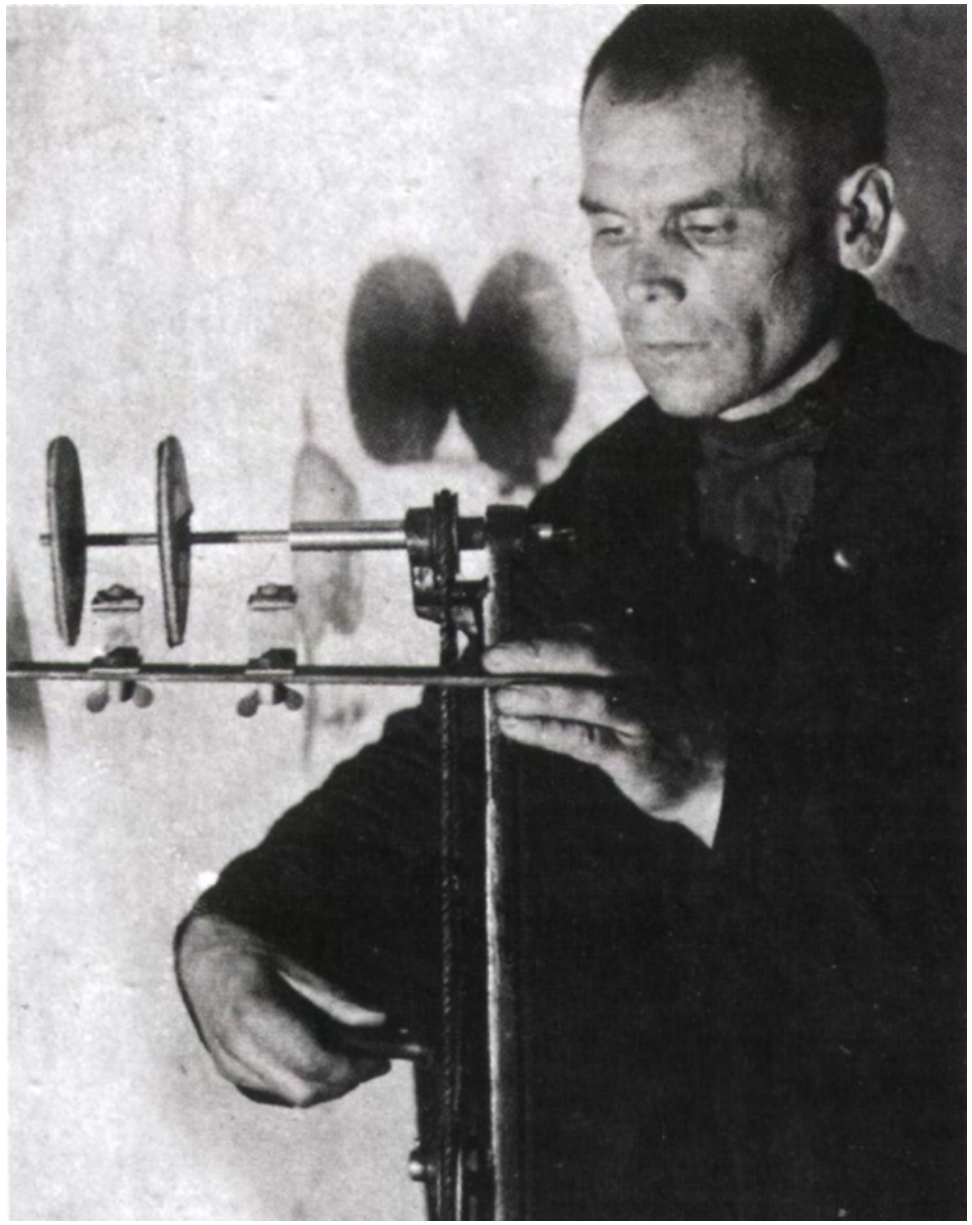


fig 6.6 Noise instrument intended for the production of Grasshopper sounds. MKhAT museum. Courtesy of Konstantin Dudakov.

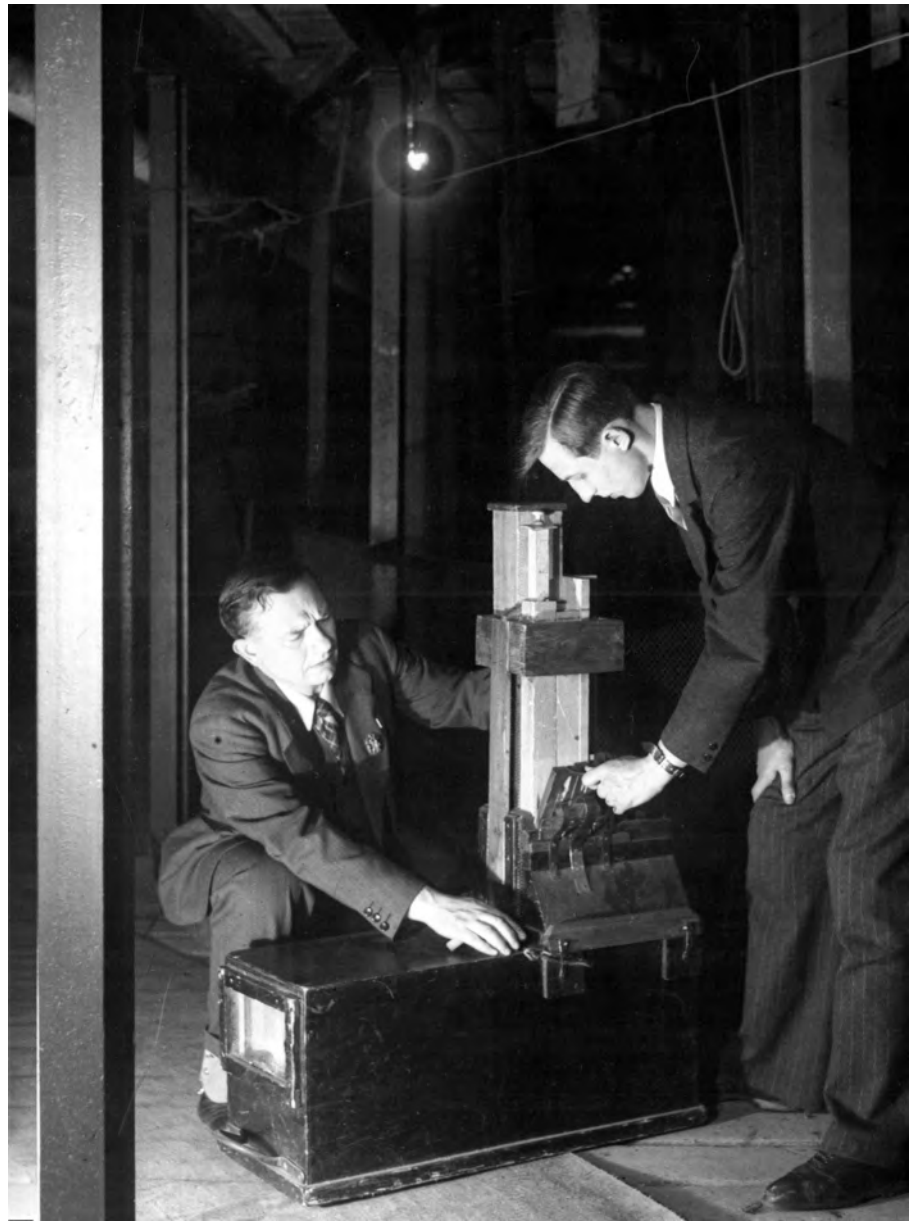
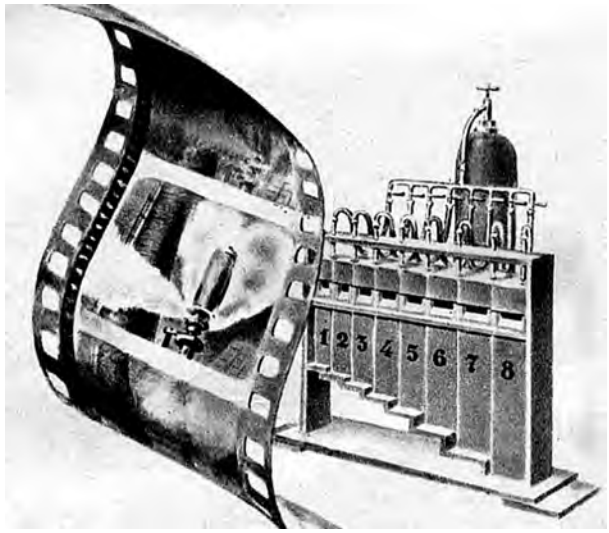


fig 6.7 Vladimir Popov with an assistant preparing a noise instrument to imitate a distant steam whistle. Back stage at the MKhAT Theatre, Moscow, late 1930s. MKhAT museum. Courtesy of Konstantin Dudakov.



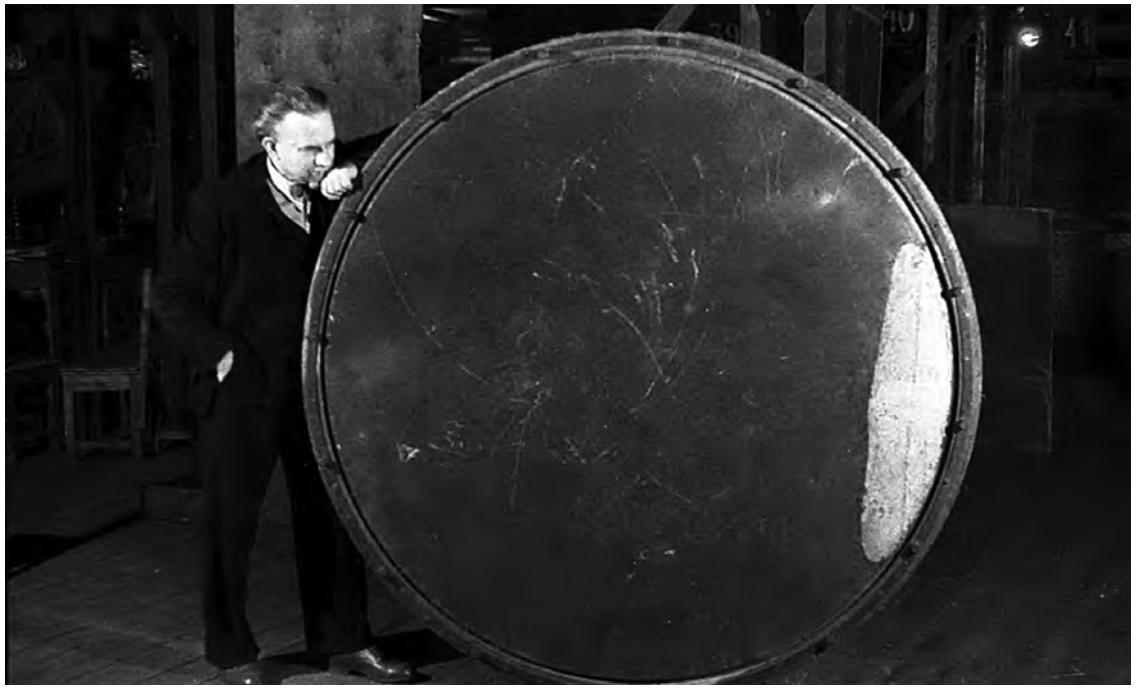


fig 6.8 Set of various metal and wooden pipes for the reproduction of different whistles, hooters and sirens for sound effects. *Tehnika molodezhi* magazine, 1941, N.6, p. 8. AS library.

fig 6.9 (Top right and bottom images) Vladimir Popov with instruments from his noise orchestra. c. 1930s. MKhAT museum. Courtesy of Konstantin Dudakov.

we can produce the sound of a dynamo-motor, taking, for example, an interval of a semitone in the low register.

The sound of the flight of an aeroplane has been produced by reproduction, also using a harmonium, of an interval of a fourth. In this case we get a non-sounding vibration (beating), i.e. a sound which is typical of the flight of an aeroplane...

Naturally, it would be a real challenge to record factory sirens and hooters as a chorus. I have started to search for ways in which to musically replace this chorus of hooters. In fact, this task is simple enough. The factory hooter is a very imperfect organ pipe... We had an acoustic table. We took a whole set of organ pipes in the register required for factory hooters, factory whistles, etc. We added some pipes of such a type that could be used as a solo. At the beginning of the hooter solo, an howl is heard: 'ouuu...' To reach this effect, it was necessary to use an organ pipe with a lowered internal key... To receive a powerful effect like that of a real factory hooter, we had to locate the microphone very close, at a distance of just a few centimetres.

To reproduce the noise of industry more complex approaches are applied. For example, there are sounds of the smithy with two working sledge-hammers. Both of them are produced by very complex chords – by using four grand pianos which have been specially prepared.

In one variant in which the grand piano definitely prevailed, the powerful impacts were similar to steps, with a very harmonious complex of sounds, but at the same time they were absolutely not decomposable on musical elements.

The theme of 'Industry' is constructed on a very special sound complex. It is based on a quartet of grand pianos which gives a rhythm of hammers. The basic development is musical – it incorporates a huge set of instruments, almost a full symphonic orchestra, even with two harps.

Let's look at how in my system we can create bells. I conducted this experiment at the Parisian exhibition. There I simply wished to make a joke, to finish a concert with the 'International'. I presented it as if the sound of the chiming clock on Spasskaya Tower (in Moscow Kremlin). When on this expanded piano (four grand pianos) you take chords, you hear sounds that cannot be distinguished from the bell sound of a chiming clock.

The possibilities offered by synthetic sound reproduction are vast. There have certainly been moments when we were compelled to apply clean noise effects. It is possible to produce perfectly any noise, for example, by means of a microphone. It is enough to take a piece of paper and to start to rustle it [demonstrates] to produce noise.

When we were very close to deadlines we sometimes applied clean noise effects, but anyway, this was not characteristic. My principle position follows on from my acoustic approach, which erases a contradiction between musical and noise effects. Both are organized sound, but organized differently. Clearer composition led to a musical effect, which became more complex, and when explored further, led to effects of the noise kind.

I did not want to involve any conventionally organized music in the film (slipping into melodic symphonic moments)... I wished to avoid entering into music absolutely. Abram Room agreed on this, but then

under the influence of criticism, he gradually started to become frightened. When chiefs and VIPs came to listen, all of them were obviously in favour of classical music. This audience made a helpless gesture and shrugged their shoulders, saying: 'It's just chaos...'

We had to compromise...[10]

fig 6.10 Sergei Eisenstein. c. 1920s. Scanned from Jerzy Toeplitz, *Historia Sztuki Filmowej*, vol. 2, table XXXVII, FAW, Warsaw, Poland, 1956.

EISENSTEIN — MONTAGE

In 1923 Sergei Eisenstein, who theorized that cinema was a synthesis of art and science, proposed a new editing form, the 'montage of attractions',[11] which initiated a sequence of theoretical works dedicated to various methods of montage from the point of view of the structure and form of a film. By 'attraction' he meant a strong, shock influence on the psychology of the spectator, directing his ideas and feelings in a way that would be beneficial for artists. Arbitrarily chosen images, independent of the action, would be presented not in chronological sequence but in whatever way would create the maximum psychological impact. It is quite likely that this concept was a consequence of the influence of Vsevolod Meyerhold who explained somewhat earlier: 'I have come to regard the *mise en scène* not as something which works directly on the spectator but rather as a series of 'passes', each intended to evoke some association or other in the spectator... Your imagination is activated, your fantasy stimulated, and a whole chorus of associations is... You can no longer distinguish between what the director is responsible for and what is inspired by the associations that have invaded your imagination. A new world is created, quite separate from the fragments of life from which the [piece] is composed.'[12]

Eisenstein believed that asynchrony between image and sound was the only real option for sound film: sound should not be synchronous, that is, it should differ from the sense of an event on the screen. Music, noise and

10 Shorthand records of the lecture by comrade Avraamov at ARRK, 20 February, 1930. Trans. AS.

11 The Russian noun *attraktsion* means 'sideshow'.

12 Meyerhold, V. 'Balagan'. *O teatre* (About theatre), *Prosveshenie*, St. Petersburg, 1913.

occasionally a word should create a second parallel semantic layer. In 1928 Sergei Eisenstein, Vsevolod Pudovkin and Grigory Alexandrov published the major aesthetic document 'The Future of Sound Film. A Statement' in which for the first time many of the problems of sound cinema were investigated. The main emphasis was placed on the idea of the contrapuntal method of combining sound and imagery.

...ONLY A CONTRAPUNTAL USE of sound in relation to the visual montage piece will afford a new potentiality of montage development and perfection.

THE FIRST EXPERIMENTAL WORK WITH SOUND MUST BE DIRECTED ALONG THE LINES OF ITS DISTINCT NONSYNCHRONIZATION WITH THE VISUAL IMAGES. And only such an attack will give the necessary palpability which will later lead to the creation of an ORCHESTRAL COUNTERPOINT of visual and aural images...

Sound, treated as a new montage element (as a factor divorced from the visual image), will inevitably introduce new means of enormous power to the expression and solution of the most complicated tasks that now oppress us with the impossibility of overcoming them by means of an imperfect film method, working only with visual images.

The CONTRAPUNTAL METHOD of constructing sound film will not only not weaken INTERNATIONAL CINEMA but will bring its significance to unprecedented power and cultural height.

Such a method for constructing sound film will not confine it to a national market, as is inevitable with the filming of plays, but will give a greater opportunity than ever before for the circulation throughout the world of a filmically expressed idea.[13]

In his theoretical works Eisenstein explored the fundamentals of narration, which he saw not only as the temporal arrangement of joining or opposing the various film shots into sequences (*the horizontal montage*) but also as the synchronous arrangement of the various aspects within the frame or shot, or the productive combination of the film picture and the sound. Through his concept of *vertical montage* Eisenstein developed a principle of audio-visual counterpoint. It refers to the interaction of various simultaneously present contrapuntal layers, lines and tensions within the work. He investigated this problem from different points of view, analyzing possibilities of the figurative correlation of music with colour, the 'tonality' of light, or a linear contour or 'overtones' of an assembly of the frame. The primary focus of this concept was discussed in the essay 'Vertical Montage' (1939) which Eisenstein prepared as a pedagogical explanation of the 'breath gesture' he claimed to have designed for the film *Alexander Nevsky* (1937).[14] Eisenstein wrote: '"Assembly elements" belong literally to almost all areas of human feelings: *Tactile-textural* (sweat streaming down wet backs). *Olfactory* (a sweat

13 Eisenstein, S., Alexandrov, G., Pudovkin, V. 'Statement on Sound' (1928), *Eisenstein. Writing. 1922-34*. Ed. R. Taylor (London: BFI, Bloomington: Indiana UP, 1994), pp.113-14.

14 Eisenstein, S., 'Vertikalni montage' (Vertical Montage). Journal *Iskusstvo kino* (The Art of Cinema), 1940, N9, s. 16-25; N12, s. 27-35; 1941, N1, s. 29-38.

smell suggestive of a wild animal). *The visual: Light...; Colour. Auditory* (a clicking of claps). *Motor* (on knees, pirouettes on heads). *Purely emotional*, "a game" (calling out with the eyes) etc.'[15]

Eisenstein wrote in his memoirs, *Beyond the Stars*: '...deep within me there is a long-standing conflict between the free course of the *all'improviso*, the flowing line of drawing or the free run of dance, subject only to the laws of the inner pulse of the organic rhythm of purpose (on one hand); and the restrictions and blind spots of the canon and rigid formula (on the other).

'Actually, it is not entirely appropriate or fair to mention formulae here. The charm of a formula is that, while laying down a general rule, it allows, within the free current which filters through it, 'special' interpretations, special cases and coefficients'.[16] In Eisenstein's works the theoretical explanation of his principles of vertical montage was based on deep analytical considerations, often explored through diagrams and graphical scores illustrating the interaction of various contrapuntal layers, lines and tensions. His approach is reminiscent of that developed by Solomon Nikritin in the framework of biomechanics and the theatrical practices of the Projection Theatre in the mid 1920s.

fig 6.11 Dziga Vertov — author of the film *Enthusiasm: Symphony of the Donbass* (1930) — the foundation of what was to become 'Musique Concrète'. Fragment of a poster for "KINO-GLAZ" from the 1920s.

DZIGA VERTOV — ENTHUSIASM: SYMPHONY OF THE DONBASS

It was Dziga Vertov who in 1929 made the first field sound recording by means of portable sound-on-film equipment, specially built for him by inventor Alexander Shorin. It allowed him to record actual urban sounds: industrial noises in the harbour, sounds of the railroad and the railway station, streets and trams, with which he produced the film *Enthusiasm*: *Symphony of the Donbass* (1930-31).■ This was the first step towards what would now be called 'Musique Concrète', invented by Pierre Schaeffer in France in 1948 and which initiated the development of electro-acoustic music.

figs 6.12-13

With *Enthusiasm* Vertov proved that it was possible to record actual noises. He considered this film a *Symphony of Noises* and it is structured as a programmatic four-movement symphony[17] in which leitmotivs and refrains develop a musical narration. Similar to the early pioneers of Electronic Music from the 1950s — but unlike Avraamov — Vertov was uninterested in using imitative instruments to recreate sounds and was irritated by such imitations in early sound films. The techniques that Vertov developed in his film were based on montage and relied on varying the speed of recorded sounds in post-production. He could edit the soundtrack by cutting sounds, putting them in loops and combining them according to principles of musical composition.

In his polemics about Arseny Avraamov (without mentioning his name), Vertov accused Abram Room of plagiarism, claiming that much of *Piatiletka* was based on materials from his silent film *11th* (1928). Regarding the soundtrack he complained that Room 'had squeezed a rattling mass of the documentary *11th* inside the prison of an acoustically isolated studio, dismembered the film in part and tattooed it with artificial toy-sounds.'[18]

In late November 1929 Vertov and the composer Nikolai Timofeev (who was later to be involved in Graphical Sound) developed a musical score that integrated noises and their transformation, distortion and variation. It is remarkable that the film also contains a unique documentary about the training of Gastev's ClT cadets, a kind of 'biomechanical ballet', also reminiscent of the performances of Solomon Nikritin's Projection Theatre.

After its first public screenings in Europe in 1931 the film achieved significant success. In a note sent to Vertov from London, Charlie Chaplin wrote: 'Never had I known that these mechanical sounds could be arranged to sound so beautiful. I regard it as one of the most exhilarating symphonies I have heard. Mr. Dziga Vertov is a musician. Professors should study with him and not argue.'[19]

AUDIO-VISUAL SPACE

During his work on the film *Piatiletka* together with Avraamov, Room asserted: 'I believe that exact synchronization of sounds in our sound film will, with rare exception — as a rule and as a basic guideline — have no application.'[20] In 1932 Avraamov in turn proclaimed:

15 Eisenstein, S., 'Vertikalni montage' (Vertical Montage). Journal *Iskusstvo kino* (The Art of Cinema), 1940, N9, s. 16-25. Trans. AS.

16 Taylor, R [Ed]. *Beyond the Stars: The Memoirs of Sergei Eisenstein*. Seagull Books Pvt. Ltd, 1995, p.589

17 Bulgakowa, O. *The Ear against the Eye: Vertov's Symphony*. Kieler Beiträge zur Filmmusikforschung, 2, 2008 / 142.

18 Dziga Vertov., 'Mart Radio-glaza' (The March of the Radio-eye). First published in *Kino Zhizn* (Cinema Life), 1930, No. 20. Trans. AS.

19 *Film Courier*, Berlin, 23.11.1931, quoted by Dziga Vertov, in 'Charli Chaplin, Gamburgskie rabochie i prikazi doktora Virta' (Charlie Chaplin, the Workers from Hamburg and the Prescriptions of Doctor Wirt), *Proletarskoe kino*, 1932, N3.

20 *Kinogazeta*, Moscow, 27 August 1929. Trans. AS.

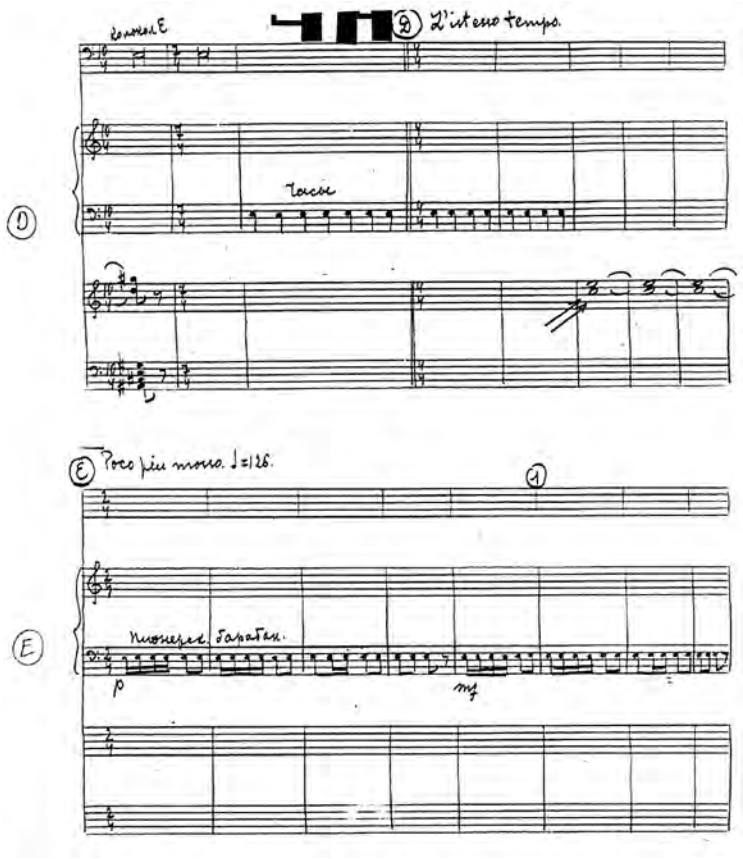


fig 6.12 Parts for the bell, watches and the pioneer drum from the sound score of the film *Enthusiasm* by Dziga Vertov. RGALI f. 2091, op. 1, d. 37, ll. 10-11.

fig 6.13 Dziga Vertov during one of the first sound recording sessions, Ukraine, 1929. *Smena* magazine, N.17, 1931, p. 21. AS library.

We are against any attempts to transfer illustrative methods into sound cinema, reducing sound design to the mechanical recording of 'symphony' sound tracks or any other 'psychological' illustrations of the events occurring on the screen. This heritage of silent cinema must be resolutely cast off from sound cinema as a method. We can put this problem in a wider context by starting with a definition of the basic system of coordinates that are suitable for the construction of unambiguous correspondences between two systems of motion: 'audible' on the sound track and 'visual' on the screen. And it is quite evident that the system of coordinates related to common three-dimensional space has unconditional correspondence to the system of coordinates related to sonic space. Musical sounds are distinguished by pitch, intensity, duration and timbre. How could we translate this into the language of visual forms?

– When a sounding object approaches the spectator from the depths of the screen in the direction of horizontal coordinate 'z', the intensity of the sound increases.

– Movement in the vertical direction 'y' corresponds to the pitch of a sound.

– Movement in the horizontal coordinate from left to right and back 'x' corresponds to the duration of sound.

– The change of the form of the sounding object itself corresponds to the change of the timbre or tone colour...

Starting from this easy and almost objective scheme, based on associations common to all humans, one can even create an abstract, objectless ornamental screen, equivalent to any musical piece, by real synthetic means – one could say, nearly 'scientifically', by formula, without the 'creative arbitrariness' of the artist.

I don't want to be misunderstood: artistic intentions can require a change to the opposite of the dynamical motion at any moment.

We do not impose on the artist any mechanical recipe but forewarn him of underestimating physiological variables... Since we are true hosts of the sound track in each portion of the frame, we simply consider that our method gives us sufficient means to turn the sound development and dynamics in any desired direction at any moment, as we are not limited by the tools of bygone material culture – musical instruments, tying our hands with their technical features and limitations.[21]

In his polemics with Vertov, Room wrote: 'I want to state my firm confidence that, while some of us are strict in conviction to base sound cinema on the dogma of shooting life "as it is", such an attempt is doomed to absolute failure.'[22] Avraamov continues by asserting: '...it was not necessary to invent *syntonfilm* and to continue bothering with violins, harps and flutes, suitable only for lyric-erotic sound recordings. *Symphony of the Donbass* must and can be written — neither with documentary clanks and

21 Avraamov, A. 1932. 'Syntonfilm'. *Proletarskoe Kino*, 1932, no. 9–10, pp. 48–51. Trans. AS.

22 Room, A. 'Nash opit' (Our experience). *Kino*, 1930, No. 2. Trans. AS.

squeaks, nor with deafening roars of “industrial noises”, but with a novel pallet of *syntonfilm* timbres, not mingled yet with the common reflexes of “chamber” and “symphonic” emotions.’[23] He refers to his favourite newly invented method of sound synthesis — Graphical Sound (aka Syntonfilm).

SHUMOVIKS AND PRACTICAL SOUND DESIGN

In the early 1930s it was a common practice to unite composers, *shumoviks* and technologists in creative teams to work on soundtracks of sound films. The most influential technologist of noise was the aforementioned Vladimir Popov and the most productive composer-*shumovik* was Nikolai Krukov, who was involved in numerous films as a composer, sound engineer and *shumovik* (sound designer).

fig 6.14 Nikolai Krukov. 1930s. RGALI.

It is remarkable that film directors and young sound artists working on sound tracks were highly informed about the most recent inventions in musical technology. For instance, in many early Russian sound films, one can find soundtracks recorded with the Theremin. Initially it was planned to release the film *Alone* by Kozintsev and Trauberg with the music composed by young Dmitry Shostakovich as the first Soviet sound movie. The soundtrack of this film already includes the part of the Theremin. However the release of the film was postponed and the opportunity passed to *Piatiletka* by Room with sound design by Avraamov, which was released in 1930.

Perhaps the most ‘condensed’ noise music of this period can be found in the film *Iziashnaya Zhizn* (The Nice Life, Rosfilm, 1932) by the film director Boris Yurtsev with the music composed by Nikolai Krukov, which includes beautiful Theremin tunes as well as various exciting noise parts, created by a whole brigade of *shumoviks* — their credits in the film titles take up more space than the cast list.

23 Avraamov, A. ‘Syntonfilm’. *Proletarskoe Kino*, 1932, No. 7 (July), p. 46. Trans. AS.

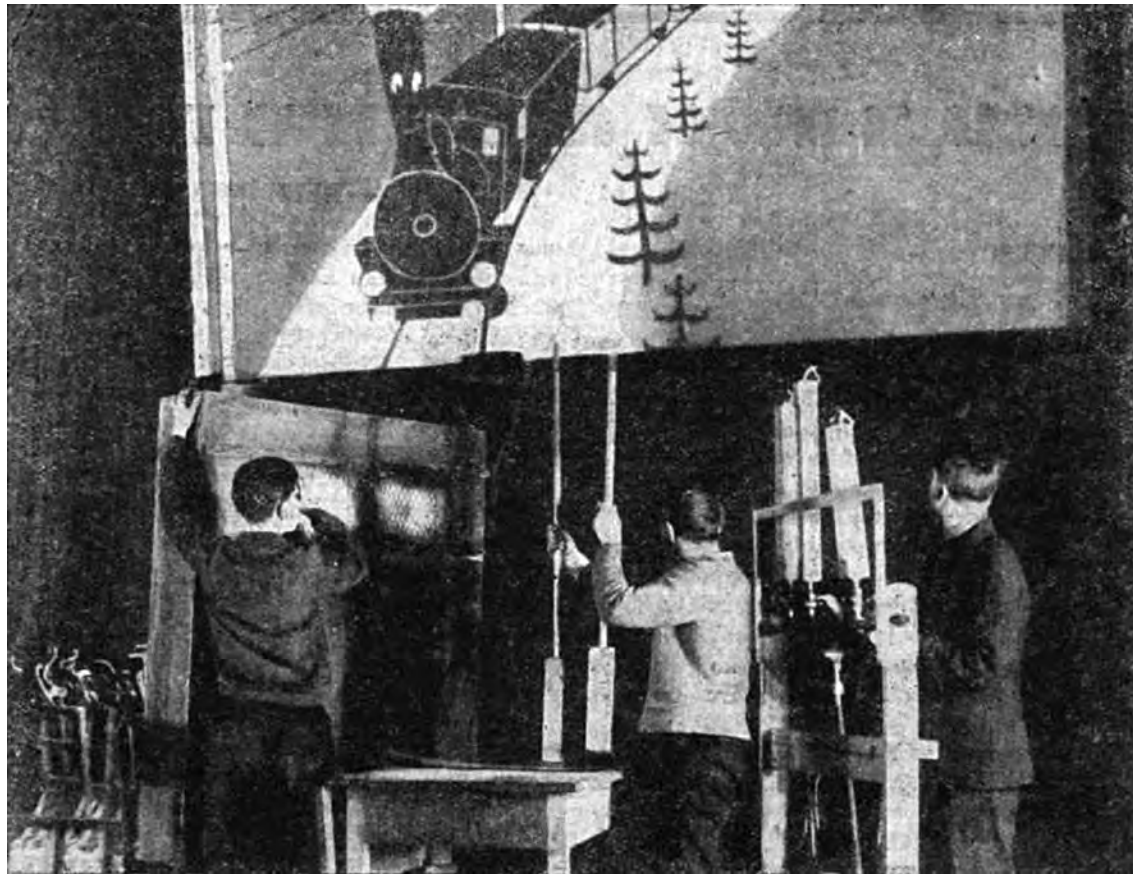


fig 6.15 Vladimir Popov’s brigade of shumoviks during a sound recording session. *Smena* magazine, N.3-4, 1932, p.29. AS library.

Among them were Vladimir Popov — the *shumovik*-constructor, assistants on sound design Valentina Ladigina, Evgeny Kashkevich, Tamara Kekina, Konstantin Peremilovsky, the Noise Department of the MKhAT-2 theatre and the sound recording equipment developed by Alexander Shorin.

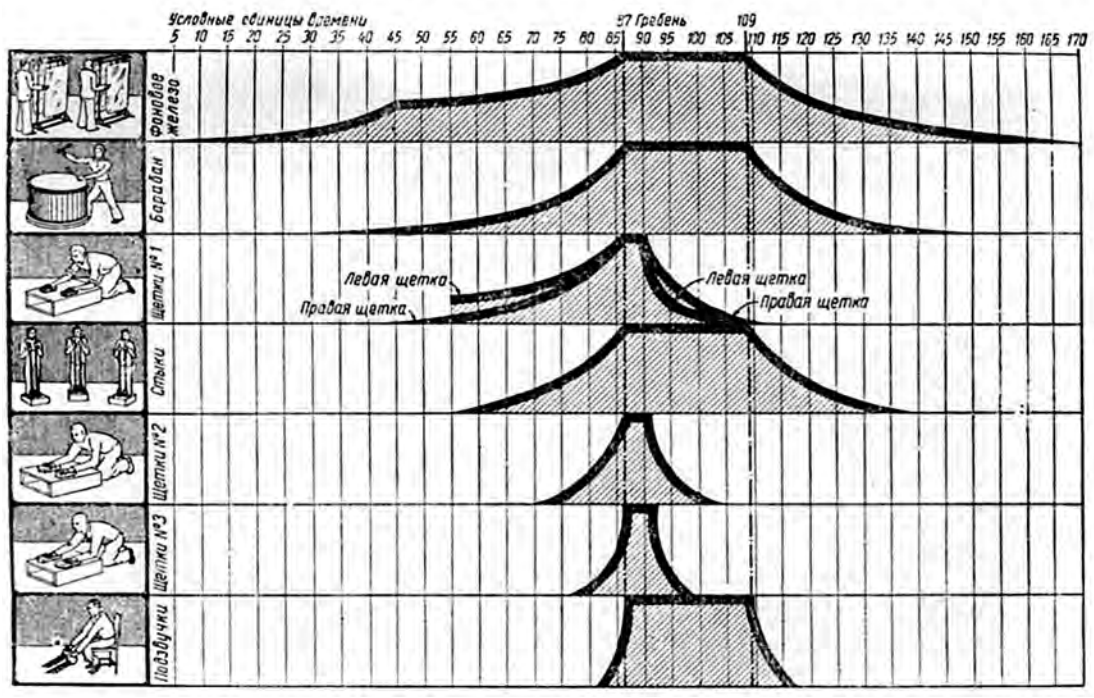


fig 6.16 Vladimir Popov's graphical score of the noise symphony of the steam locomotive passing by. c. 1930s. From the book by V. Popov *Shumovoe oformlenie spektaklia* (The sound design of the spectacle), Iskusstvo, Moscow, 1953, p. 145. Courtesy of Konstantin Dudakov.

Another magnificent but underrated, censored and largely forgotten film with the participation of Nikolai Krukov was *Dela i ludi* (Affairs and people) by the film director Alexander Macheret. It was the first sound movie produced by the Mosfilm company in 1932. It is interesting that the soundtrack was created by a team that included one of the most influential Russian 'classical' composers, Vissarion Shebalin (the Rector of Moscow Conservatory in 1942-48), film composer Sergei Germanov and the *shumovik* Nikolai Krukov as well as the noise technologist Popov. The result proved to be both extraordinary and futuristic. It is not surprising that the Theremin was also utilized in the production of the soundtrack. One of the famous Soviet film directors, Mikhail Romm, who was involved as an assistant in the production of this film, recollected: 'We knew nothing. We had to invent everything... Sound technicians were covering microphones with gauze, surrounding them with special grids, putting rubber over them, etc. Expert acousticians were coming in, clapping, shouting "A", and listening to the echo. The sound, however, did not become better... The sound technician was then both a dictator and a tyrant. He could demand after a rehearsal: "Comrades, actors, I ask you to pronounce all "A's" much softer, all "Y's" much louder; try to raise a little bit the letter "E"; don't push the hissing, say it casually, hardly at all. "B" and "P" — speak these as distinctly as possible"... We hired another sound technician [Nikolai Timartsev]. He seemed a very competent and decent person ... And the sound got better.'[24]

The main concept of their sound design was defiantly complex: 'Music should be accompanied by noises and be born from them. I remember one symphonic étude from the film: at first, girls were striking liquid dirt with the wooden beaters, depicting the rhythmic footfall of workers kneading concrete, a clang of chains joined it, followed gradually by the orchestra and then the symphony of concrete started to sound... In addition to all that, Popov developed for us a noise symphony. Dozens of *shumoviks* rattled, clanked, whistled, barked, hooted and clattered with different pieces of wood and metal. They represented the sounds of cranes, trains, the wind, the footfall of concrete workers and thousands of other sound components of the large construction.'[25] The final result was absolutely convincing. It is surprising how gradually and naturally the noise textures flow into each other as well as the sounds of the orchestra. The movements of gears and mechanisms are perfectly synchronized with the complex orchestral rhythm structures.

Meanwhile the newest sound recording technology was bulky, poor and inconvenient. No means for sound editing and mixing had yet been developed so the process of composing a soundtrack including both an orchestra and various noises required new approaches to music scores as well as new means by which to develop an accurately pre-calculated timeline. According to Romm: 'In general we made improbable experiments with sound while no re-recording and remixing was possible. Therefore it was necessary to shoot synchronously not only actors, but also the orchestra, and if noises also needed to be added, it became extremely difficult to work on... A most complicated score was written, broken into frames according to measures, the rhythm established exactly according to a metronome. Then it was necessary to mount these cuts of music, speech and noise in a single whole. It was a work of inconceivable complexity. One phrase was shot together with music and noise, then the next phrase, and the music and noise had to begin with the frame on which they had stopped the previous day. All that had to coincide with the rhythm and tonality.'[26]

24 Romm, M. *Izbrannie proizvedenia*. Moscow, 1982, pp.119-125. Trans. AS.

25 *Ibid.*

26 *Ibid.*

7. GRAPHICAL SOUND

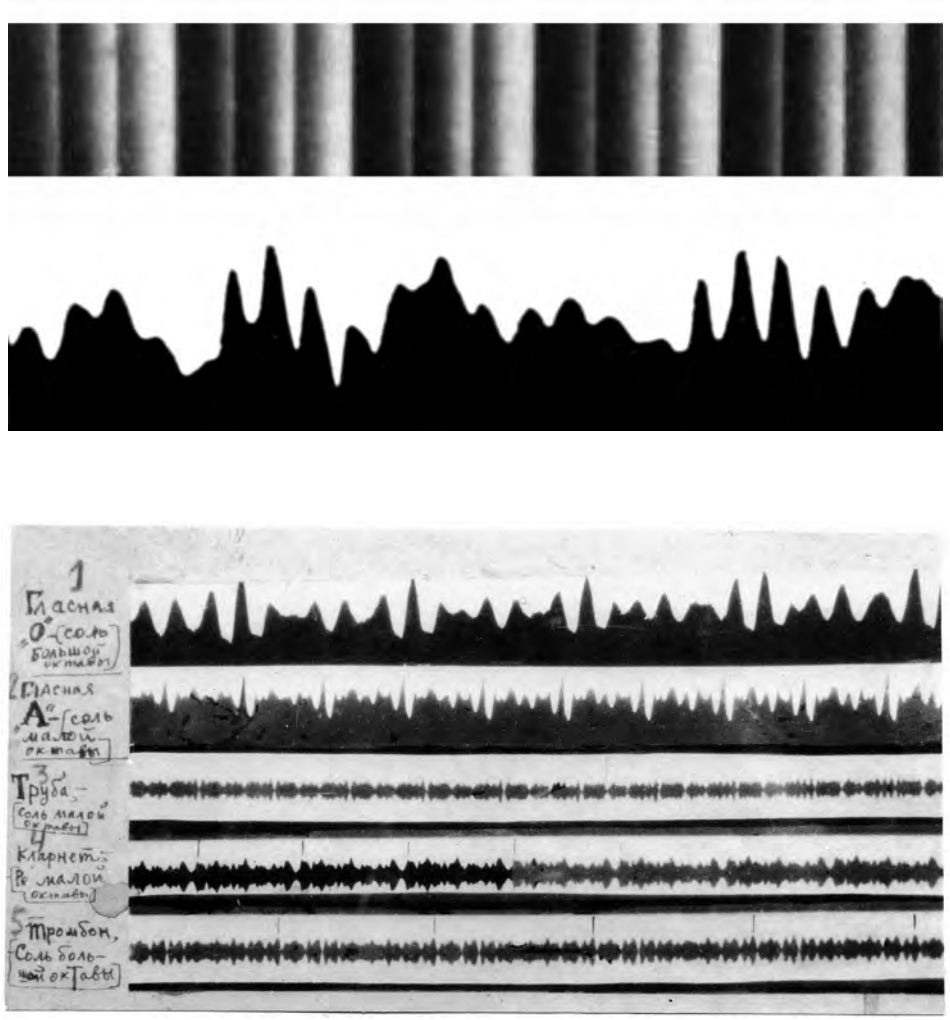


fig 7.1 Intensive (top) and transversal soundtracks. Diagram by A. Smirnov.

fig 7.2 Transversal soundtracks, recorded by Boris Yankovsky in 1934 by means of Shorin's Kinap system. TCA.

SOUND-ON-FILM AND GRAPHICAL SOUND

Graphical (Drawn) Sound is a technology of synthesizing sound from light that was developed in Soviet Russia in 1929 as a consequence of the newly invented sound-on-film technology, which made possible access to sound as a visible graphical trace in a form that could be studied and manipulated. It also opened up the way for a systematic analysis of these traces such that they could be used to produce any sound at will.

The first practical sound-on-film system created in Moscow by Pavel Tager in 1926, the *Tagephon*, was based on 'intensive' variable density optical recording on film,■ while in Shorin's *Kinap* system, developed in Leningrad in 1927, the method of 'transversal' variable area optical recording on film was realized.■ Another version of Shorin's system, the *Shorinophone*, which was widely used for field and studio sound recording, was based on the mechanical reproduction of gramophone-like longitudinal grooves along the filmstrip.

fig 7.1

fig 7.2, 7.47

Among the first Soviet sound movies ever created was the aforementioned *Piatiletka. Plan velikih rabot* (The Plan of Great Works) by Abram Room. The group working on this film in 1929 at Shorin's Central Laboratory of Wire Communication in Leningrad, included the painter, book illustrator and animator Mikhail Tsekhanovsky, the chief of the composer's brigade Arseny Avraamov and the inventor Evgeny Sholpo, who was already working on new techniques of so-called 'performerless' music. When in October of that year the first roll of film was developed, it was Tsekhanovsky who voiced the idea: 'What if we take some Egyptian or ancient Greek ornaments as a sound track? Perhaps we will hear some unknown archaic music?'[1] He was referring to the shapes and outlines of vases and how these could be used as wave forms to generate sound. It was at this precise moment that *Graphical Sound* techniques were invented.

The next day they were already furiously at work on experiments in what they referred to variously as 'ornamental', 'drawn', 'paper', 'graphical', 'artificial' or 'synthetic' sound — techniques that offer the capacity to synthesize any sounds as well as any polyphonic musical pieces, based on mathematical and acoustical data. The laboratories that were soon created became the first-ever prototypes of the future centres for computer music.

While most inventors of electronic musical instruments were developing tools for performers, the majority of methods and instruments based on Graphical Sound techniques were created for composers. Similar to modern computer music techniques, the composer, producing the final soundtrack, had no need for any performers or intermediaries.

Owing to the cross-disciplinary nature of the new technique, people involved in it had to possess a wide range of knowledge, being skilled in music, acoustics, mathematics, sound-on-film technology and

1 Avraamov, A. 'Sinteticheskaya muzika' *Sovetskaya Muzika*, 1939, No.8, pp.67-75. Trans. AS.

engineering. Without any developed terminology many unexpected 'puzzles' appear in their writings. For instance, it is almost impossible to understand the reflections of several journalists regarding Yankovsky's techniques without having a clear idea about his methods and their acoustical and psychoacoustical basis. It is quite obvious that these ideas couldn't be understood by most of Yankovsky's contemporaries. For example, reading about 'coloured rainbows' in relation to sound refers to acoustics rather than poetic metaphors, since the phenomena of both visible rainbows in optics and audible timbres in acoustics are related to the idea of spectra.

Moreover, there were several known research groups — competitors in Russia and Germany working in parallel. It led to a very specific problem — encryption of the information. For example, Yankovsky had a very special way of making notes on his ideas. It is impossible to understand the construction of his tools from reading one description without referring to several other manuscripts that offer important keys for understanding it. At the same time even sufficient explanations are fragmented and these fragments are often located in different parts of the manuscript, meaning that the researcher has to spend days comparing different parts of texts and illustrations (which are also often fragmented) in order to combine the information to find anything meaningful.

Meanwhile, on the well-known photographs from the early 1930s Oskar Fischinger holds 'fake' rolls made by his Studio for publicity purposes as he did not want his competitors to learn his actual techniques. He never used rolls as large as this — they were dummies.[2] Although there were several short articles published in German,[3] French[4] and English[5] most publications about research and developments in the USSR were only in Russian. At the same time many of the most important documents were never published at all and were circulating only in manuscript form, similar to Samizdat (self-published forbidden literature). By 1936 there were several main, relatively comparable trends of 'Graphical Sound':

1 Hand-drawn 'Ornamental Sound', achieved by means of shooting still images of drawn sound waves on an animation stand, with final sound-tracks produced in a *transversal* form (Avraamov, early Yankovsky).

2 Hand-made 'Paper Sound' with final *transversal* sound-tracks (Nikolai Voinov).

3 The *Variophone* or 'Automated Paper Sound' with sound-tracks in both *transversal* and *intensive* form (Evgeny Sholpo, Georgy Rimsky-Korsakov).

2 According to information received from the Fischinger Trust, the Center for Visual Music.

3 Von, A.L. 'Die Grosse Erfindung — "Graphomusik"' (The Great Invention — 'Graphomusik'), *Moskauer Rundschau*, 15.03.1931.

4 'Le "Variophone"', *Le Journal de Moscou*, 01.06.1935.

5 Solev, V. 'Absolute Music by Designed Sound'. *American Cinematographer.* April, 1936, pp.146-148, 154-155; 'Sketches' Sound; Files It For 'Talkies'. *Modern Mechanix,* February, 1936, p.83.

4 The 'Syntones' method, based on the idea of spectral analysis, decomposition and resynthesis, developed in 1932-35 by Avraamov's pupil, the young painter and acoustician Boris Yankovsky.

At exactly the same time very similar efforts were being undertaken in Germany by Rudolf Pfenninger in Munich and, somewhat later, by the animator and filmmaker Oskar Fischinger in Berlin. Among the researchers working with Graphical Sound after World War II were the famous filmmaker Norman McLaren (Canada) and the composer and inventor Daphne Oram (UK).

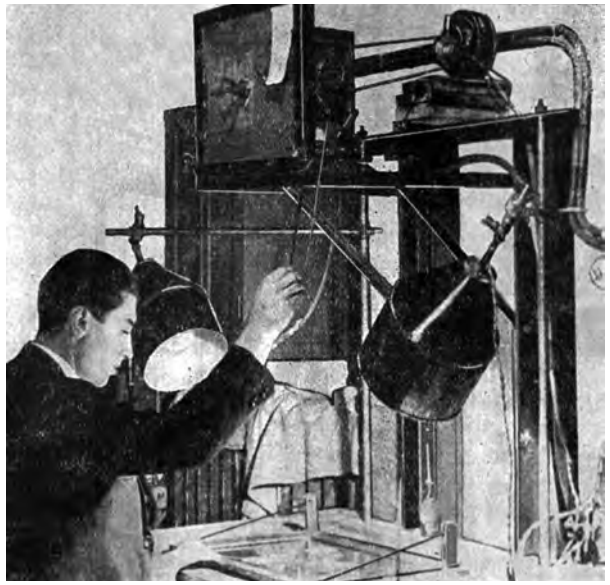


fig 7.3 Animation stand for producing ornamental soundtracks. The composer draws the pieces of pre-calculated soundtrack relating to each frame of film on paper, photographing them frame by frame onto the soundtrack of the filmstrip by means of a rostrum camera. Afterwards this filmstrip is played as a common sound movie by means of a film projector. From the book *Multiplikacionni film*, Kinofotoizdat, Moscow, 1936. AS library.

HAND-DRAWN ORNAMENTAL SOUND

In 1930 Arseny Avraamov was the first to demonstrate experimental sound pieces produced purely with drawing methods. Having made drawings of geometric profiles and ornaments, he then shot still images of these drawn sound waves on an animation stand.■ On 20 February 1930 Avraamov mentioned a new trend in his lecture to the sound-on-film group at ARRK.[6] On 30 August 1930 during the First Conference on Animation Techniques in Moscow, Avraamov demonstrated artificial drawn sound pieces in his presentation 'Ornamental Sound Animation'. According to Vladimir Solev: 'Five years ago, at the very beginning of sound-on-film, at

fig 7.4-5

6 Shorthand records of lecture by comrade Avraamov in the group of sound cinema of ARRK, 20 February 1930. ARRK — abbreviation of the Association of Workers of Revolutionary Cinematography. Trans. AS.

a conference, the theorist-composer Arseny Avraamov was the first to demonstrate experimental pieces, based on geometric profiles and ornaments, produced purely with drawn methods. Later his former assistants found their own specific methods.'[7] In October 1930 the new technique was described in the article 'Multiplikacia Zvuka' (the Animation of Sound) by E. Veisenberg.[8] Two months later in December 1930, one of the founders of the new technique, filmmaker Mikhail Tsekhanovsky, wrote in his article 'O Zvukovoi Risovannoi Filme' (About drawn sound film): 'With the invention of new drawn sound techniques (developed by Arseny Avraamov in Moscow, Sholpo and [Georgy] Rimsky-Korsakov in Leningrad) we are achieving a real possibility of gaining a new level of perfection: both sound and the visual canvas will be developing completely in parallel from the first to the last frame... Thus drawn sound film is a new artistic trend in which for the first time in our history music and art meet each other.'[9] According to an article published in 1931:

Composer Arseny Avraamov at the scientific research institute conducts interesting experiments with the creation of hand-drawn music. Instead of common sound recording on film by means of microphone and photocell, he simply draws geometrical figures on paper before photographing them onto the sound track of the filmstrip. Afterwards this filmstrip is played as a common movie by means of a film projector.

Being read by photocell, amplified and monitored by loudspeaker, this filmstrip turns out to contain a well-known musical recording, while its timbre is impossible to associate with any existing musical instrument. Comrade Avraamov is now conducting a study into the recording of more complicated geometrical figures. For instance, recording graphical representations of the simplest algebraic equations and drawing the molecular orbits of some chemical elements. In this research the composer is assisted by a group of young employees from the Research Institute for Film and Photography. By the end of December Avraamov will finish his new work and show it to the film community. Quite possibly abstracts of 'Hand-Drawn Music' will also be presented in a radio broadcast.[10]

Oskar Fischinger's statements, first published in 1932, were quite similar: 'Between ornament and music persist direct connections, which means that Ornaments are Music. If you look at a strip of film from my experiments with synthetic sound, you will see along one edge a thin strip of jagged ornamental patterns. These ornaments are drawn music — they are sound: when run through a projector, these graphic sounds broadcast tones of a hitherto unheard purity, and thus, quite obviously, fantastic possibilities open up for the composition of music in the future.'[11]

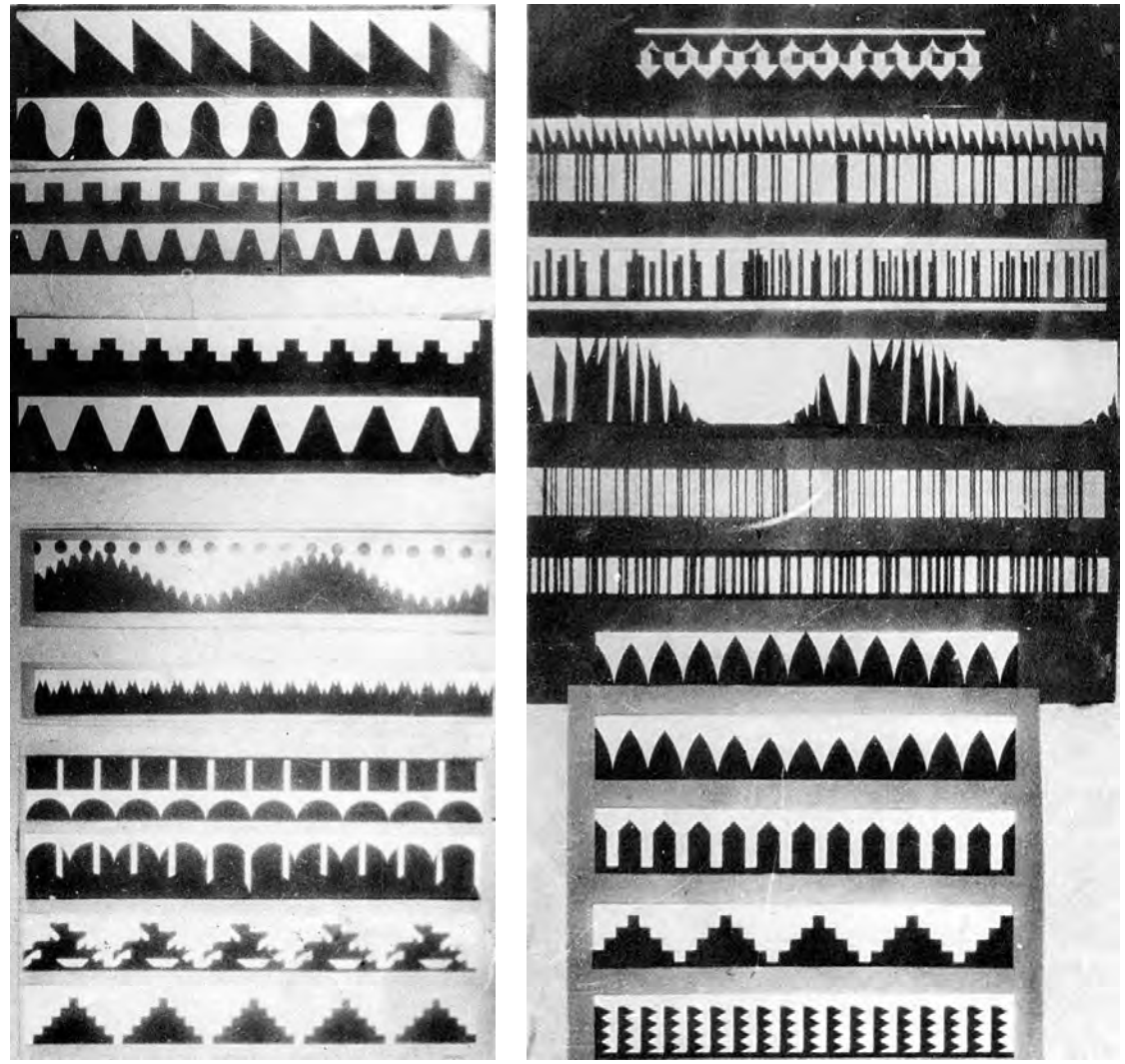


fig 7.4–5 Ornamental soundtracks, drawn by Arseny Avraamov in Moscow, 1930 and 1931. TCA.

7 Solev, V. 'Synteticheskу Zvuk', *Kino*, 31.07.1935, p.4. Trans. AS.

8 Veisenberg, E. 1930. 'Multiplikacia Zvuka'. *Kino-Front*, Leningrad, 20.10.1930, no. 52, p.3. Trans. AS.

9 Tsekhanovsky, M. 'O Zvukovoi Risovannoi Filme', *Kino I Zhizn*, Moscow. 1930, No. 34-35, p.14. Trans. AS.

10 'Drawn Music'. *Kino*, Moscow, 16.12.1931. Trans. AS.

11 Fischinger, O. 'Sounding Ornaments', *Deutsche Allgemeine Zeitung*, 08.07.1932.

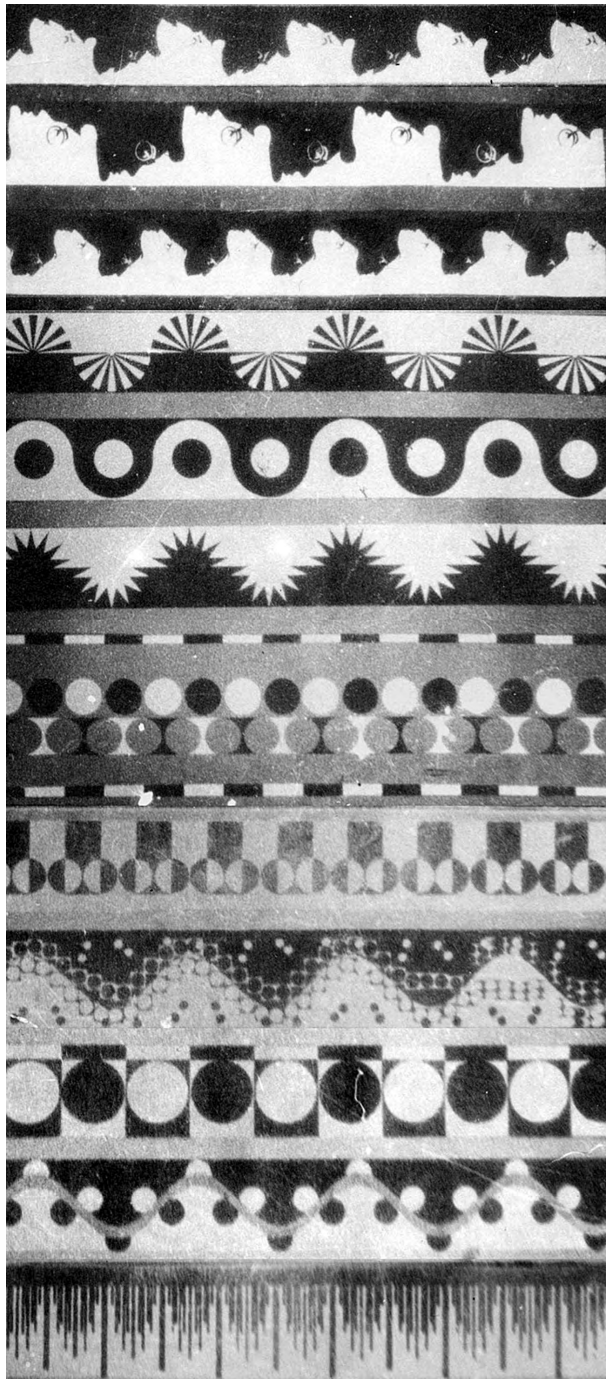


fig 7.6 Soundtrack-profiles of Boris Yankovsky (left) and Arseny Avraamov, drawn by Yankovsky in 1931. TCA.

fig 7.7 Ornamental soundtracks, drawn by Boris Yankovsky in Moscow, 1931. TCA.

As a result of the fashion for microtonal 'ultrachromatic' music, most Russian approaches to synthetic music production and related tools were microtonal. Most discussions were focused on possibilities for achieving the natural (overtone) scale and related harmony, keeping all advantages of the equal-tempered scale. There were numerous systems of harmony developed that were based on the new equal temperaments. Among them were the forty-eight/ninety-six-step scale by Avraamov (which he named the 'Welttonsystem'), the seventy-two-step scale by Boris Yankovsky, the forty-one-step scale by Pavel Leiberg, and the Ober-Unter-Tone Harmony system by Samoilov.

In the autumn of 1930 Avraamov founded the Multzvuk Group. His research was focused mainly on harmony in the new microtonal 'Ultrachromatic' music. To produce his first drawn ornamental soundtracks he had a small number of staff: a special draughtsman, operator Nikolai Zhelynsky, animator Nikolai Voinov, and acoustician Boris Yankovsky, who was responsible for the translation of musical scores into Avraamov's forty-eight-step microtonal Welttonsystem, as well as into Andrey Samoilov's Ober-Unter-Tone Harmony system.■ The final scores were coded in Yankovsky's seventy-two-step Ultrachromatic scale with the dynamic shades indicated in terms of light exposure (a diaphragm of a movie camera) and speed variations indicated by the number of frames. Yankovsky was also involved in acoustical experimental studies, developing methods for the synthesis of sounds with glissando, timbre cross-fades and variations and polyphony by means of multiple shooting on the same optical soundtrack (a type of multi-track recording).

figs 7.6-7, 7.36

A year later in the autumn of 1931 the Multzvuk Group moved to NIKFI (The Scientific Research Institute for Cinema and Photography) and was renamed the Syntonfilm Laboratory. In December 1932 NIKFI stopped supporting Syntonfilm and the group moved to Mezhrabpomfilm[12] where in 1934 it was closed as it was unable to justify itself economically. In 1935 Avraamov, composer and politician Boris Krasin (one of the founders of the Union of Composers) and the scholar Alexei Ogolevets founded the Autonomous Research Section (ANTES) at the Union of Composers in Moscow. ANTES was intended to develop research into new tonal systems, new electronic musical instruments and Graphical Sound and Syntonfilm. Among the participants in ANTES were some of the best researchers and inventors of electronic musical instruments of the time including Andrey Volodin (the *Ekvodin* Synthesizer), Alexander Ivanov (the *Emiriton*), Konstantin Kovalsky (the *Theremin*), and Nikolai Ananiev (the *Sonar*). Georgy Rimsky-Korsakov was the head of the ANTES branch in Leningrad. ANTES was the last significant manifestation of creativity with its roots in the forward-looking 1920s. On 28 January 1936 the infamous *Pravda* article 'Confusion Instead of Music'[13] vilifying the music of Dmitry Shostakovich was published, initiating a war by the totalitarian State on the freedom of artistic expression. Although the article was anonymous,

12 One of the leading film production companies, created in 1928 in Moscow. In 1948 it was renamed 'Kinostudia imeni Gorkogo' — Gorki Film Studio.

13 'Confusion Instead of Music. About the opera *Ledi Makbet Mtsenskovo uyezda* (Lady Macbeth of the Mtsensk District)'. *Pravda* Newspaper, 28.01.1936.

many historians assign its authorship to the head of the Committee of Arts and the communist party functionary Platon Kerzhentsev. After the death of Boris Krasin on 21 June 1936 ANTES was closed and all experimental projects lost their funding and support.

From 1930-34 over 2,000 metres of ornamental sound tracks were produced by Avraamov's Multzvuk Group and Syntonfilm, including the experimental films *Ornamental Animation*, *Marusia otravilas*, *Chinese Tune*, *Organ Chords*, *Untertonikum*, *Prelude*, *Piluet*, *Staccato Studies*, *Dancing Etude* and *Flute Study*. The whole archive had been kept for several years at Avraamov's apartment, where it is thought that in 1936-38, during a trip by Avraamov to Caucasus, it was burned by his own sons, making rockets and smoke screens with the old nitro-film tapes, which were highly flammable.

fig 7.8 Nikolai Voinov cutting his paper soundtracks. Moscow, 1931. TCA.

PAPER SOUND

Nikolai Voinov (1900-58) began his career as an animator in 1927. In 1930 he was involved in the production of the first drawn ornamental soundtracks at Avraamov's Multzvuk laboratory. In 1931 he left and started his own research at the Cartoon Studio of the Moscow Film Factory as a developer of 'Paper Sound' techniques. These were based on the synthesis of sound waves by means of paper cutouts with the carefully calculated sizes and shapes produced by his newly invented tool, the Nivotone.■

fig 7.9

According to Vladimir Solev: 'Voinov would painstakingly cut out short cog shapes from sheets of paper, with each cog representing a single semitone in the range of eighty piano keys. For each note he would take a contoured "comb" of cogs with the density related to the pitch, similar to the combs of natural soundtracks. Low pitches have a low density of cogs, while for higher pitches they are condensed and thin.'[14]

14 Solev, V. 'Syntetichesky Zvuk', *Kino*, July 31, 1935, p.4. Trans. AS.

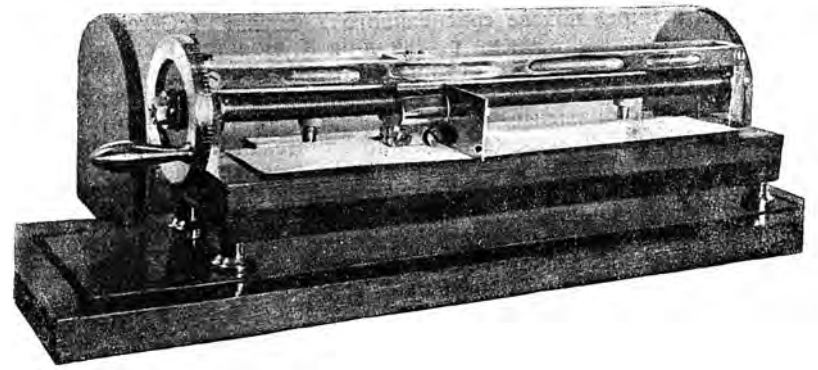


fig 7.9 Nivotone tool. 1931. From the book *Multiplikacionni film*, Kinofotoizdat, Moscow, 1936. AS library.

As of 1931 Voinov was involved in the activities of the IVVOS group (Ivanov, Voinov, Sazonov). This group produced a number of animated cartoons with synthetic soundtracks (often called 'Ivvostone') including *Barinia* (The Lady) (1931), *Rachmaninov Prelude* (1932), *The Dance of the Crow* (1933), *Tsvetnie polia*, *Linii bezopasnosti* (Colour Fields, Lines of Safety) (1934) and *Vor* (The Thief) (1935).

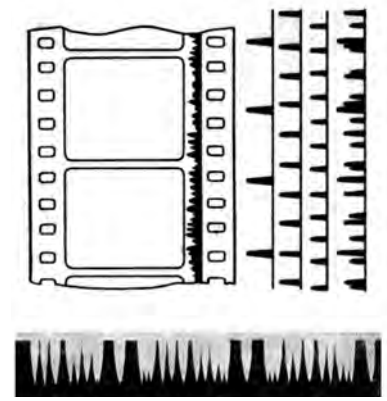


fig 7.10 Illustration of Paper Sound method and final soundtrack. From the book *Multiplikacionni film*, Kinofotoizdat, Moscow, 1936. AS library.

Voinov was the first to synthesize piano sounds: his method offered a surprisingly efficient level of control over the dynamics of sound. According to Solev: 'Then Voinoff [sic] made his "piano", all of which can be fitted into a necktie box. Each of its keys, i.e., each halftone, is represented by a long "comb", which is a schematic record of the piano... In this manner, he succeeded in photographing two three-minute items: a *Prelude* by Rachmaninoff [sic], and a fox-trot *The White Monkey*. The prelude showed especially interesting results. The "designed music" (to be more exact, it was music cut out of paper) came out as an abstract design of diverging circles and prisms. Voinoff [sic] has also recorded a cartoon film *The Thief*, in which he has preserved the rhythms very tightly.'[15]

15 Solev, V. 'Absolute Music', *Sight and Sound* magazine (U.S.), 1936, N18, p.48 (in English).

In early 1936 Voinov was dismissed from the Moscow Film Factory and his laboratory was closed. For the rest of his life he worked successfully as an operator at Souzmultfilm Studios[16]. In Voinov's official biography from Communist times his most experimental works from 1931-36 are not even mentioned. According to the memories of animator and illustrator Evgeny Migunov, Voinov belonged to the 'generation of the 1920s — a generation with characteristics of the time that distinguished them as a new formation. His latent intelligence, total absence of impudence and absolute decency guaranteed him unconditional respect.'[17] Migunov observed that 'for most of his life he was deeply disappointed as his main ideas and potential were unrealized' and attributed Voinov's heavy drinking and related problems to this long-standing frustration. This sense of unfulfilled ambition was common to many other pioneers of the period.

fig 7.11 Evgeny Sholpo's Graphical Sound Laboratory in Leningrad. c. 1946. Courtesy of Marina Sholpo.

EVGENY SHOLPO AND THE LABORATORY FOR GRAPHICAL SOUND, LENINGRAD

When in October 1929 the idea of Drawn Sound was voiced, Sholpo proposed to Alexander Shorin, the chief of the Central Laboratory of Wire Communication in Leningrad, a research project about synthetic Graphical Sound production. Shorin was cautious — he suggested starting with existing sound recording techniques combining live sound recordings to produce a new musical piece. In 1930 he provided Sholpo with a working space, a film editing board and a microscope. Shorin recorded the sounds of a flute and clarinet playing chromatic scales and suggested Sholpo try to produce meaningful music by re-editing and sticking pieces of sound together in different orders. In this way Sholpo produced two Russian songs — *Kamarinskaya* (a Russian folk song) and *Down Mother-Volga River*.[18]

By early 1931 at Lenfilm Studios[19] with assistance from the composer Georgy Rimsky-Korsakov (grandson of the famous composer Nikolai Rimsky-Korsakov), Sholpo made a soundtrack for the short propaganda film *The Year 1905 in Bourgeois Satire* (film-director Noi Galkin, composer Vladimir Deshevov). The soundtrack of this film was also based on re-edited natural sound recordings. The same year Sholpo, together with Rimsky-Korsakov, created several experimental drawn ornamental soundtracks.

fig 7.12 Evgeny Sholpo working with the first version of the Variophone in 1932. Courtesy of Marina Sholpo.

In the autumn of 1931 the film director Eduard Ioganson suggested that Sholpo produce a graphical soundtrack to his new film *Tempi Reshayut* (Tempo Solving). Especially for this purpose the Bureau of Realization of Inventions at the Lenfilm Studios agreed to fund the construction of the first simplified version of the Variophone, which was finally built by Sholpo together with Georgy Rimsky-Korsakov in 1931.■ At the end of the summer of 1932 Sholpo and Rimsky-Korsakov produced a synthesized soundtrack for the new colour cartoon *The Symphony of Peace* by Ioganson and Georgi Bankovsky and in the autumn of 1933 they made a soundtrack for the educational film *The Carburettor* with music composed by Georgy Rimsky-Korsakov.■ Among their most accomplished pieces recorded with the Variophone in 1933-35 were *Waltz* by Nikolai Timofeev, *Flight of the Valkyries* composed by Richard Wagner, and *6th Rhapsody* composed by Franz Liszt. Although aesthetically these works are similar to Walter Carlos' *Switched-on Bach* (1968) and sound like 'eight-bit music',

figs 7.12-16

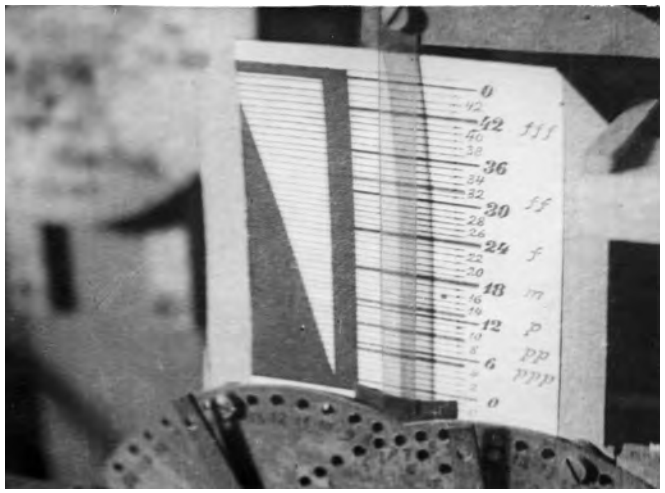
figs 7.17-18

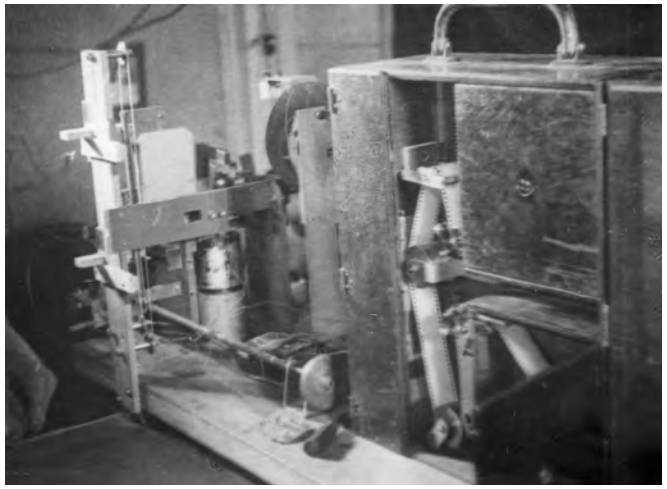
16 The main cartoon production company in the USSR based in Moscow.

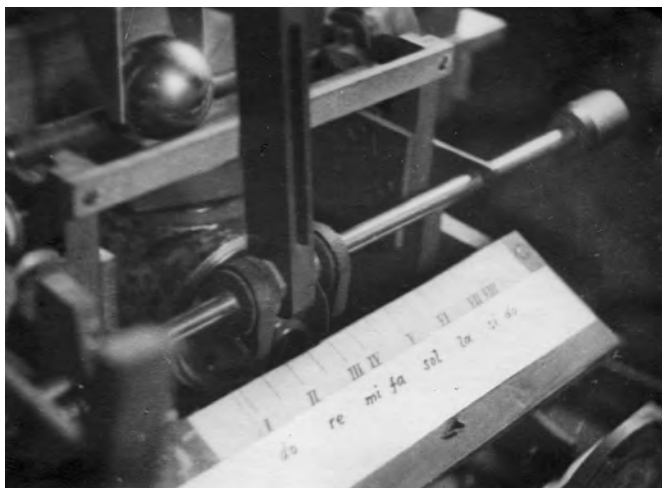
17 Migunov, E. 'O Voinove' (About Voinov), 20.07.1997. http://www.animator.ru/articles/article.phtml?id=96. Trans. AS.

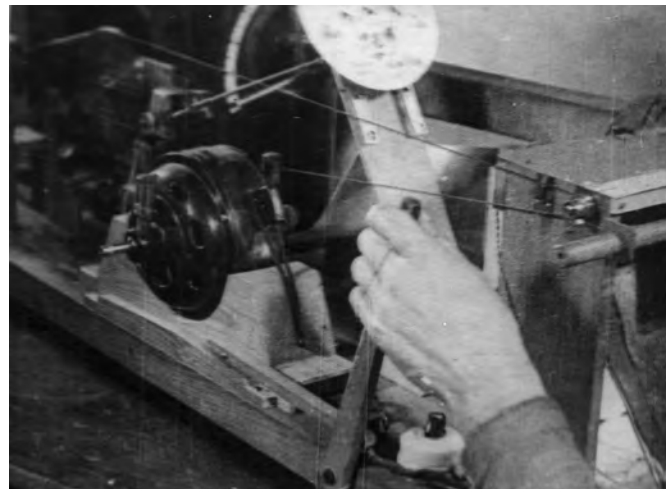
18 The timeline 1929-1950 is based on Evgeny Sholpo's diary 'Chronika po materialam autobiografii E.A.Sholpo' (The Chronicle Based on Materials of Sholpo's Autobiography). Marina Sholpo's private archive.

19 One of the main film production companies in Soviet Russia, based in Moscow.









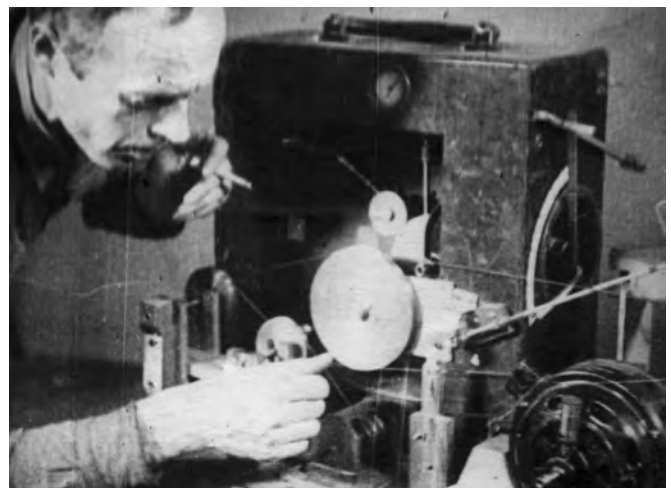


fig 7.13 (includes images on facing page) Variophone, version 1, 1932. Courtesy of Marina Sholpo.

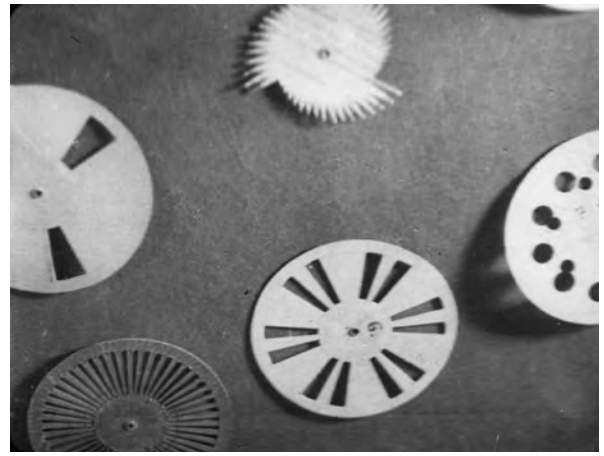
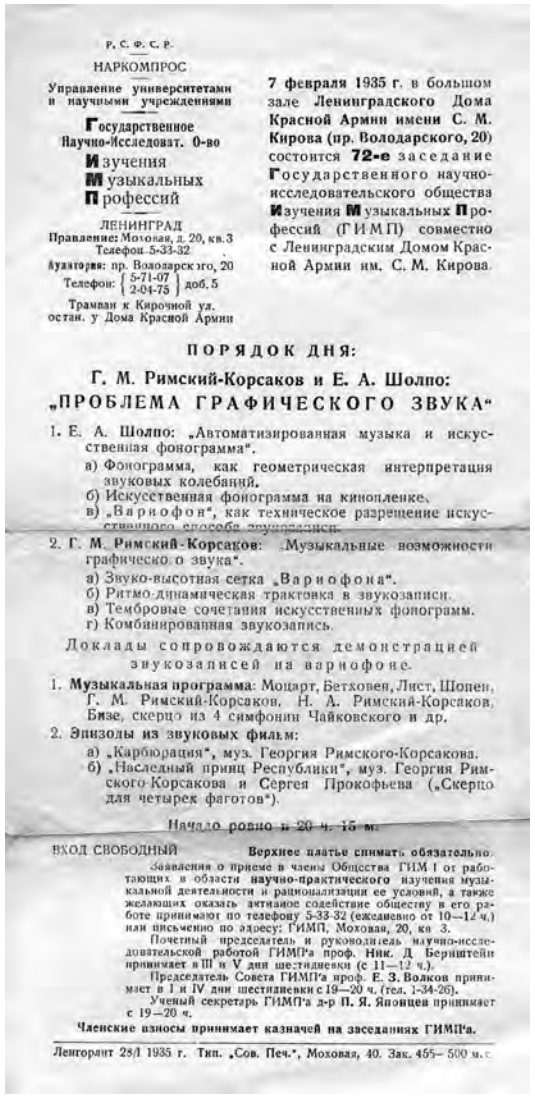


fig 7.14 The process of loading the Variophone optical disk. 1932. Courtesy of Marina Sholpo.

fig 7.15 The first version of the Variophone. Leningrad, 1931-32. Courtesy of Marina Sholpo.

fig 7.16 The process of producing the Variophone optical disks with cut wave shapes. Version 1, 1932. Courtesy of Marina Sholpo.



Р. С. Ф. С. Р.

НАРКОМПРОС

Управление университетами и научными учреждениями

Государственное Научно-Исследоват. О-во Изучения Музыкальных Профессий

ЛЕНИНГРАД

Правление: Моховая, д. 20, кв. 3
Телефон 5-33-32

Аудитория: пр. Володарского, 20
Телефон: 5-71-07 / 2-04-75 доб. 5

Трамваи к Кирочной ул. остан. у Дома Красной Армии

7 февраля 1935 г. в большом зале **Ленинградского Дома Красной Армии имени С. М. Кирова (пр. Володарского, 20)** состоится **72-е** заседание Государственного научно-исследовательского общества Изучения Музыкальных Профессий (ГИМП) совместно с Ленинградским Домом Красной Армии им. С. М. Кирова.

ПОРЯДОК ДНЯ:

Г. М. Римский-Корсаков и Е. А. Шолпо:

„ПРОБЛЕМА ГРАФИЧЕСКОГО ЗВУКА"

1. Е. А. **Шолпо**: „Автоматизированная музыка и искусственная фонограмма".
   а) Фонограмма, как геометрическая интерпретация звуковых колебаний.
   б) Искусственная фонограмма на кинопленке.
   в) „Вариофон", как техническое разрешение искусственного способа звукозаписи.
2. **Г. М. Римский-Корсаков**: „Музыкальные возможности графического звука".
   а) Звуко-высотная сетка „Вариофона".
   б) Ритмо-динамическая трактовка в звукозаписи.
   в) Тембровые сочетания искусственных фонограмм.
   г) Комбинированная звукозапись.

Доклады сопровождаются демонстрацией звукозаписей на вариофоне.

1. **Музыкальная программа**: Моцарт, Бетховен, Лист, Шопен, Г. М. Римский-Корсаков, Н. А. Римский-Корсаков, Бизе, скерцо из 4 симфоний Чайковского и др.
2. **Эпизоды из звуковых фильм**:
   а) „Карбюрация", муз. Георгия Римского-Корсакова.
   б) „Наследный принц Республики", муз. Георгия Римского-Корсакова и Сергея Прокофьева („Скерцо для четырех фаготов").

Начало ровно в 20 ч. 15 м.

ВХОД СВОБОДНЫЙ **Верхнее платье снимать обязательно.**

Заявления о приеме в члены Общества ГИМ I от работающих в области научно-практического изучения музыкальной деятельности и рационализации ее условий, а также желающих оказать активное содействие обществу в его работе принимают по телефону 5-33-32 (ежедневно от 10—12 ч.) или письменно по адресу: ГИМП, Моховая, 20, кв. 3.

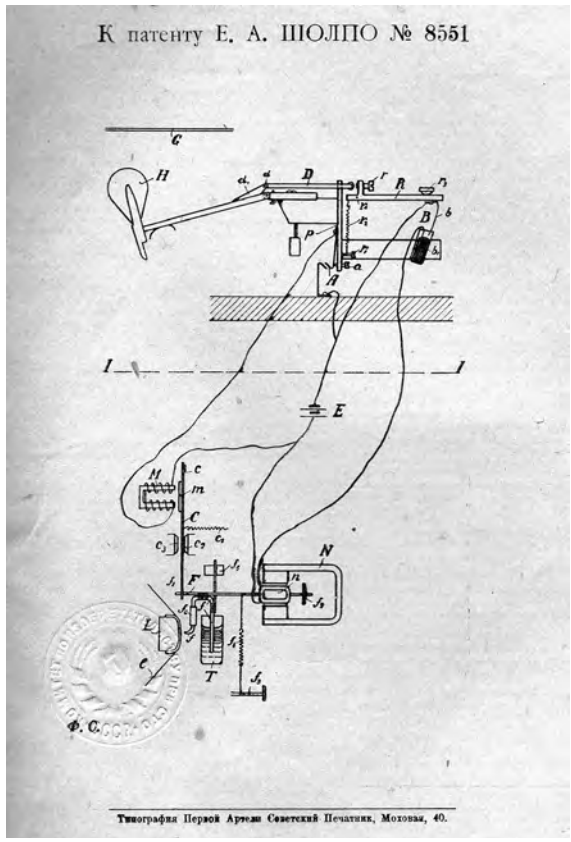
Почетный председатель и руководитель научно-исследовательской работой ГИМП'а проф. **Ник. Д. Бернштейн** принимает в III и V дни шестидневки (с 11—12 ч.).

Председатель Совета ГИМП'а проф. **Е. З. Волков** принимает в I и IV дни шестидневки с 19—20 ч. (тел. 1-34-26).

Ученый секретарь ГИМП'а д-р **П. Я. Японцев** принимает с 19—20 ч.

Членские взносы принимает казначей на заседаниях ГИМП'а.

Ленгорлит 28/I 1935 г. Тип. „Сов. Печ.", Моховая, 40. Зак. 455— 500 м. с.



К патенту Е. А. ШОЛПО № 8551

Типография Первой Артели Советский Печатник, Моховая, 40.

fig 7.17 Programme of the concert-lecture by Evgeny Sholpo and Georgy Rimsky-Korsakov. Leningrad, 1935. Courtesy of Marina Sholpo.

fig 7.18 Composer Georgy Rimsky-Korsakov. 1920s. Courtesy of Lidia Ader.

fig 7.19 Patent of the Melograph. 1927. Courtesy of Marina Sholpo.

the main difference is in their rhythm and timing. While much early popular electronic music has a rigid, metronome-like tempo, Sholpo was able to simulate more subtle variations in rhythm such as *rubato*, *rallentando* and *accelerando*, based on his careful analyses of live piano performances by some of the leading pianists of the day. It was a continuation of research that he had been conducting since 1917 when he developed special tools — the Melograph ■ and Autopianograph — capable of registering the rhythm and temporal characteristics of live musical performance, which were finally patented in April 1927.[20] fig 7.19

Although the Variophone development went well, in March 1935 Sholpo was dismissed from Lenfilm Studios. Fortunately the same year Boris Krasin, who had just been appointed Commissar of the Soviet exposition at the 1937 Paris World's Fair, invited Sholpo to present his graphical sound program during the exhibition. At the same time Sholpo was invited to join the ANTES branch in Leningrad. For a short period the laboratory received better funding and additional staff, and Sholpo was able to start developing the second (and most successful) version of the Variophone. After Krasin's death in 1936 the Paris project was dropped and in January 1937 Sholpo's laboratory was passed to the Leningrad Musical Scientific Research Institute without staff or sufficient funding.

In the summer of 1937 Sholpo managed to present his works in Moscow. The program was performed for a commission including the most important Soviet musicians and researchers from the Moscow State Conservatory and NIMI Institute — Nikolai Garbuzov, Alexander Goldenweiser, Alexander Gedike and Piotr Riazanov. The conclusion of the commission was somewhat favourable and further to this Gedike and Garbuzov wrote personal reviews. Nevertheless, it failed to make any impression on the head of the Committee of Arts Affairs, Platon Kerzhentsev, and nothing really changed in the official status of Sholpo's laboratory.

However, after October 1937 the Musical Scientific Research Institute managed to renew the contract on the development of the Variophone with Sholpo. In 1938 after some changes among the administrative board of the Institute and the Committee of Arts Affairs (particularly the resignation of Platon Kerzhentsev), Sholpo's project gained new support and, as an unexpected consequence, in 1941, just before World War II crossed the borders of the USSR, Sholpo was awarded an honorary Doctoral Degree in the History of Arts.

In 1939 Sholpo and Yankovsky decided to unite their efforts to establish a new Laboratory for Graphical Sound in Leningrad. The staff of the laboratory included Sholpo (the head), Yankovsky (scholar-inventor), Titman (assistant-photographer), and Igor Boldirev (composer-researcher). The main activities of the laboratory were to be focused on the recording of new *syntone*-based synthetic instruments.

During this year Sholpo began developing the third version of the Variophone, which was almost finished by 1941 but remained nonfunctional until 1946 due to several critical mistakes in its construction and the War. Yankovsky expected to complete his main tool — the Vibroexponator — in

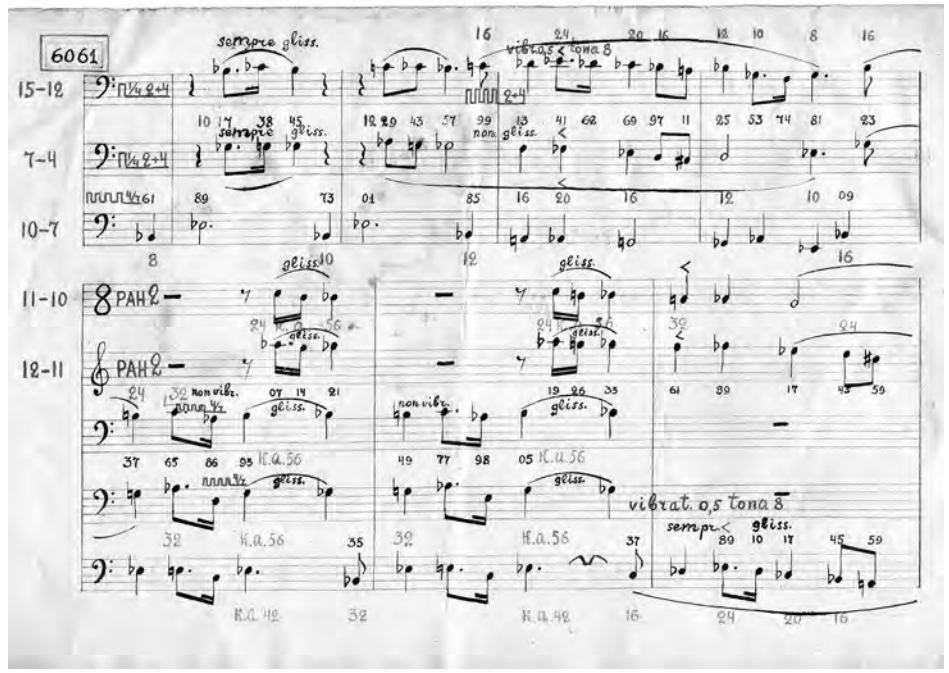
20 Patent No. 7162, class 51c, 5: 'Device for the registration of keyboard performance'. Applied for 11.04.1927 (Application No. 17 231), received 30.11.1928.

1940. In 1939-41 Sholpo wrote a seminal book *Teorija i praktika grafich-eskogo zvuka* (The Theory and Practice of Graphical Sound).[21] One chapter of the book 'Acoustical Synthesis of Musical Colours' [22] was written by Yankovsky, but their work on the publication was curtailed by World War II — all research stopped and the book remained unpublished. In 1941 during the blockade of Leningrad, together with composer Boldirev, Sholpo synthesized one of his most experimental pieces — the soundtrack to the cartoon *Sterviatniki* (The Vultures).■ As a fee they were given a sack of oats, which was gratefully received because they were in the middle of a terrible famine at the time.[23] On 31 January 1943[24] the most functional second version of the Variophone was destroyed when one of the last missiles exploded in Leningrad.

figs 7.20-21

After the War, in 1946, Sholpo became a director of the new Scientific Research Laboratory for Graphical Sound at the State Research Institute for Sound Recording in Leningrad. Finally Sholpo's laboratory had a building, funding and staff, but produced few practical results. The fourth and final version of the Variophone was never finished in spite of some very interesting studies of musical intonation[25] and research into mathe-matical simulation of rhythm and temporal characteristics of live musical performance,[26] undertaken by Boldirev. Having no skills in management and finance, inventor Sholpo was totally lost in paperwork and his official correspondence with the bureaucracy. In 1948 a criminal case was brought against him. He was accused of wasting resources. The facts were not proved to be true and the prosecution was dropped, but Sholpo was removed from his position as director. The laboratory was moved to Moscow and became a part of the Research Institute of Sound Recording. In 1950 the Laboratory for Graphical Sound was finally closed and shortly after that, in 1951, Sholpo died.

The archives of the Laboratory in part were passed to the Acoustical Laboratory at Moscow State Conservatory. In the mid 1970s they were thrown out together with other discarded archives, old acoustical devices and the remainder of Leon Theremin's gadgets, left after his exile from Moscow State Conservatory in 1967. Fortunately the sound engineer Lev Bolotsky saved much of this material and passed it to the Theremin Centre in the 1990s. Thousands of historical documents were also col-lected in the private archive of Marina Sholpo, daughter of the inventor. Almost two hours of graphical soundtracks had survived and were discovered and collected by film-historian Nikolai Izvolov at Moscow Film Museum. By wonderful coincidence, the programme of Graphical Sound was finally presented in Paris seventy years later in October 2008 as part



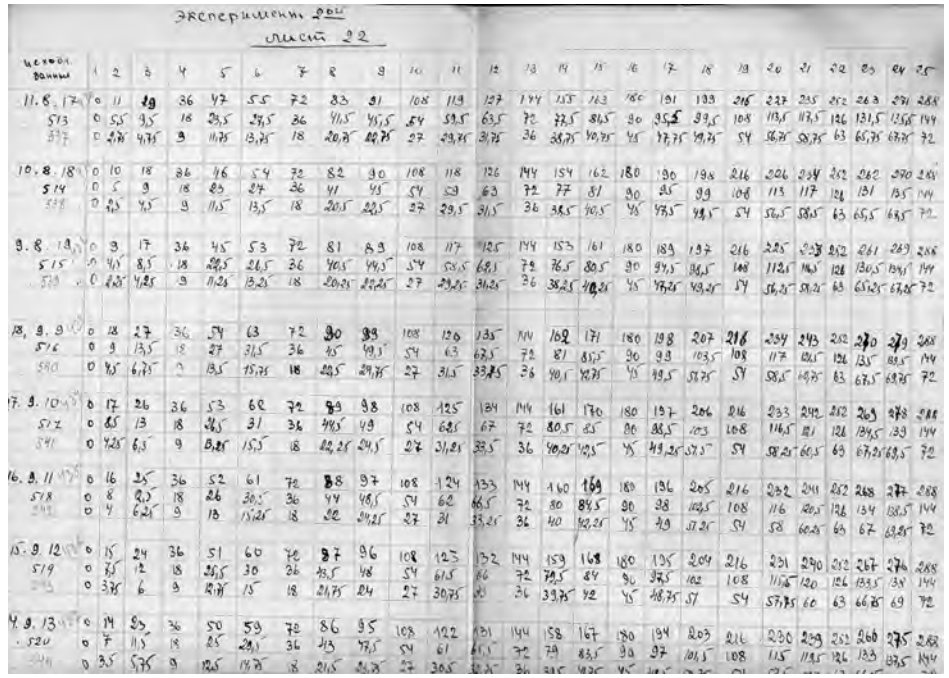


fig 7.20 The score of *Sterviatniki*. Leningrad, 1941. Courtesy of Marina Sholpo.

fig 7.21 Table with the final numeric score data to be programmed. Late 1930s. Courtesy of Marina Sholpo.

21 Marina Sholpo's private archive.

22 AS archive.

23 Anfilov, G. *Phisika I muzika* (Physics and Music), Detgiz, Moscow, 1962, p.150.

24 As recorded in Evgeny Sholpo's diary 'Chronika po materialam autobiografii E.A.Sholpo'. Marina Sholpo's private archive.

25 'Theoretical basis of live intonation applied to graphical sound. Studies of Variophone Ver.3'. *Report No. 23/1, Scientific-Research Laboratory for Graphical Sound*, Leningrad, 1946. TCA.

26 'Objective study of the performance texture of 'Nocturne' by Schopen performed by three pianists.' *Report No. 1-172-49, Scientific-Research Laboratory for Graphical Sound*, Leningrad 1949, TCA.

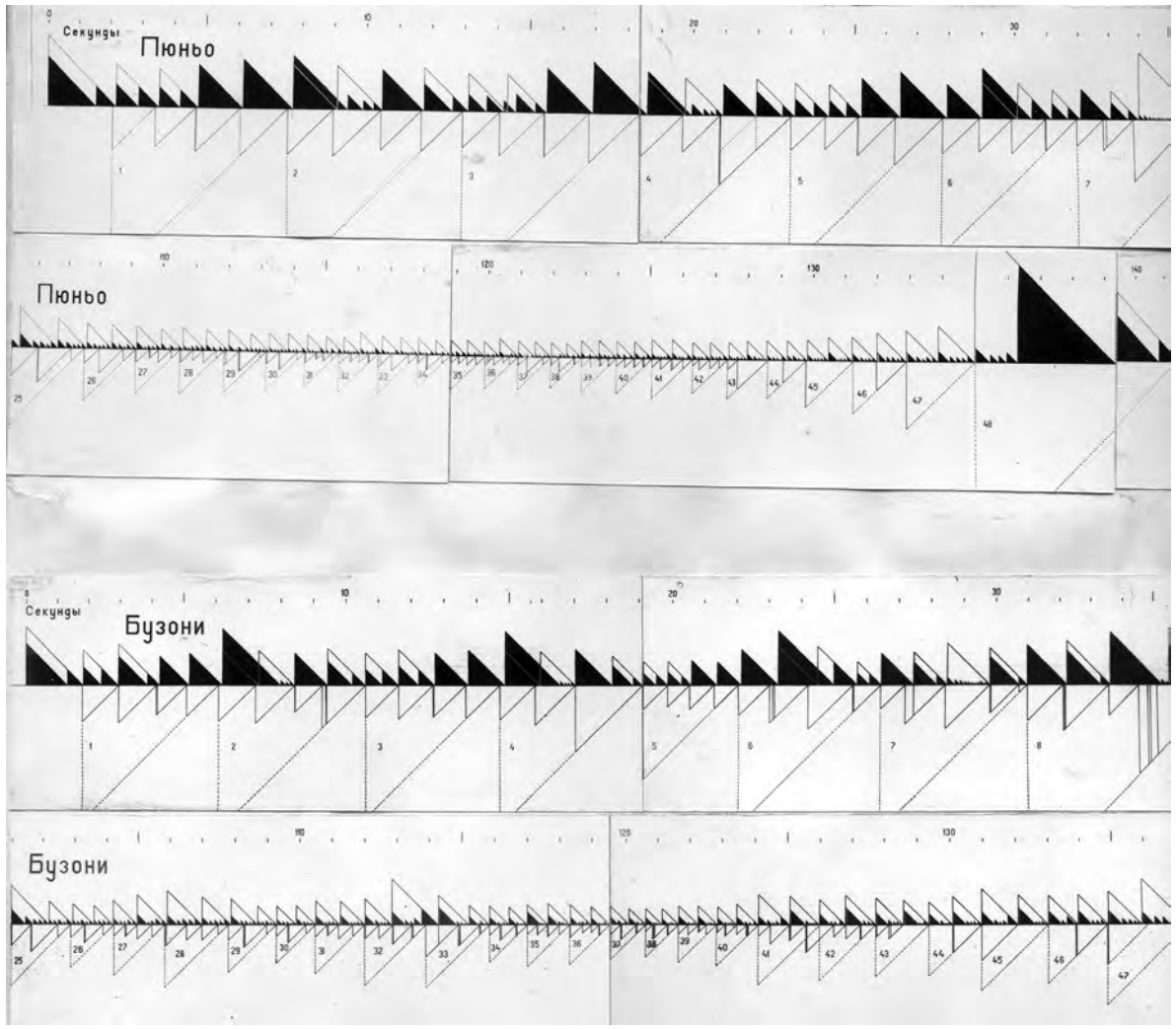


fig 7.22 Rhythmograms. Courtesy of Marina Sholpo.

of the exhibition *Sound in Z* at the Palais de Tokyo — a building that was constructed in 1937 especially for the French exposition at the 1937 Paris World's Fair.

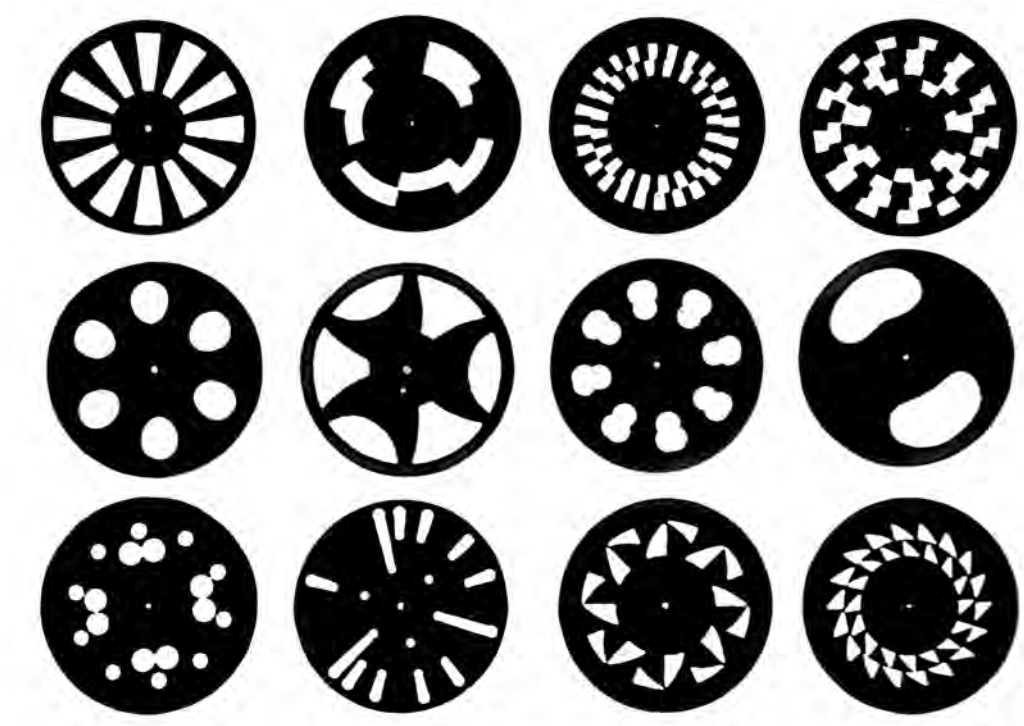


fig 7.23 Optical disks for the first version of the Variophone. Courtesy of Marina Sholpo.

THE VARIOPHONE

In May 1930 Sholpo, during his work at Alexander Shorin's Central Laboratory of Wire Communication in Leningrad, applied for a patent on a 'method and device for the production of a periodic sound track on film',[27] describing the system, which was later named the Variophone with several improvements added by means of supplementary applications on 21 September 1930[28] and 25 November 1931.[29] For this invention he successfully obtained a copyright certificate on 31 August 1931. In October 1930 he applied for a patent on a method of additive synthesis of graphical soundtracks: 'a mechanism for the transformation and addition of harmonious fluctuations with different amplitudes'.[30]

27 Copyright Certificate No. 22 312 for the invention 'Method and device for the production of the periodic sound track on film' by E. A. Sholpo, applied for 13.05.1930 (Application No. 69 944).

28 Copyright Certificate No. 34 780 for the invention 'Device for chronographic sound recording' by E. A. Sholpo, applied 21.09.1930 (Application No. 76 283).

29 Copyright Certificate No. 30 467 for the invention 'Sound recording devices' by E. A. Sholpo, applied for 31.05.1931 (Application No. 22 312).

30 Copyright Certificate No. 34 761 for the invention 'Mechanism for the transformation and addition of harmonious fluctuations with different amplitudes' by E. A. Sholpo, applied for 18.10.1930 (Application No. 77 617).

The first version of the instrument was built with assistance from the composer Georgy Rimsky-Korsakov in 1931 at Lenfilm Studios ■ (see figs **7.12-16**, **7.23**, **7.26**, **7.33**). It was capable of producing artificial sound-tracks by means of Automated Paper Sound techniques. According to Solev: 'Sholpo's method makes access easier to varieties of timbres. He doesn't shoot still images of sounds on an animation stand, instead using paper disks with circular images of combs with appropriate shapes of cogs, rotating synchronously with a moving filmstrip. The exclusive benefits of the Variophone are in its flexible pitch control and vibrato.' [31]

figs →

Although the very first version of the Variophone was made with wooden parts fixed by wires and tuned with ropes, it already incorporated one of the most crucial and necessary devices — a mechanism for the precise and continuous changing of the speed of rotation of the optical disk with the sound wave pattern, i.e. a means of controlling the pitch with the possibility of synthesizing continuous glissandi. Also from the very beginning the composer had full freedom to work with polyrhythmic combinations and almost unlimited tempi in any passages.

The Variophone was continuously under development and by 1936 the arsenal of musical and acoustical means of the second version had been highly enriched by the capacity for free glissando with a speed of up to four octaves per second, flexible and precise control over dynamics, and options for deep vibrato in pitch, volume and timbre. ■ The Variophone could produce polyphonic soundtracks by means of multiple exposure with up to twelve parallel voices. Even compared with the subsequent and more advanced third and fourth versions, it produced the most impressive quality and complexity of sound.

fig 7.28

fig 7.24 The building of the Laboratory for Graphical Sound. Leningrad, 1946. Courtesy of Marina Sholpo.

In 1939 Sholpo began developing the third version of the Variophone, which was almost finished by 1941 but remained nonfunctional until 1946 due to several critical mistakes in its construction. In the fourth and

31 Solev, V. 1935. 'Syntheticheskiy Zvuk'. *Kino*, July 31, 1935, p.4. Trans. AS.

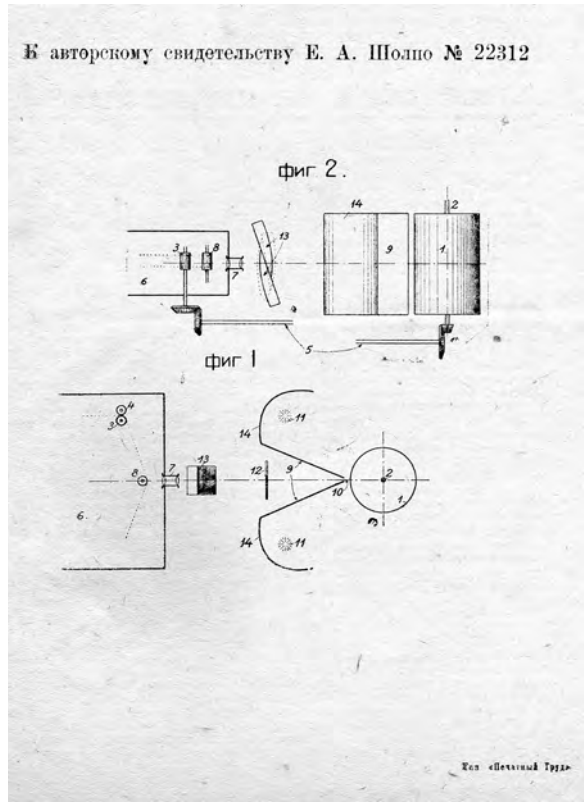


fig 7.25 Poster for Evgeny Sholpo's lecture-concert of tape-music, synthesized by means of the Variophone. Moscow, 1941. Courtesy of Marina Sholpo.

fig 7.26 (Bottom two images) The first Copyright Certificate related to the Variophone. Courtesy of Marina Sholpo.

Схема „Вариофона“ Е.А.Шолпо.

Названия узлов

		№ деталей
I	Электромотор	1,2
II	Коробка скоростей	3,4,5
III	Транспонирующий редуктор	6,7,8,9
IV	Конусный редуктор	10,11,12
V	Звуковысотная шкала	13,14
VI	Держатель графика	15,16,17
VII	Привод	18,19,20,21,22
VIII	Камера	23,24,25,26,27,28
IX	Осветительное устройство	29
X	Автомат силы	30,31,32,33
XI	Редуктор автомата силы	
XII	Автовибратор	34,35
XIII	Автомат-журнал	36,37
XIV	Счетчик	
XV	Автостоп	
XVI	Нумератор (не показан)	
XVII	Синхронизирующее устройство	

fig 7.27 The Variophone diagram. Courtesy of Marina Sholpo.

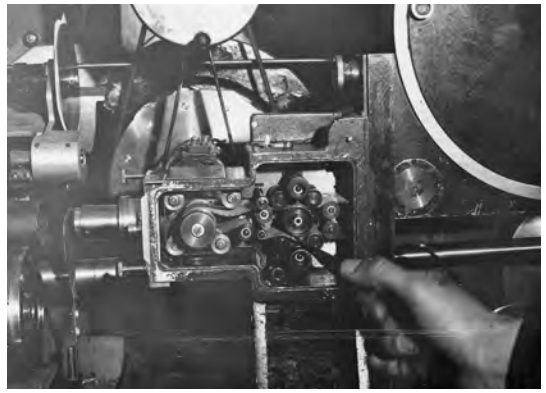
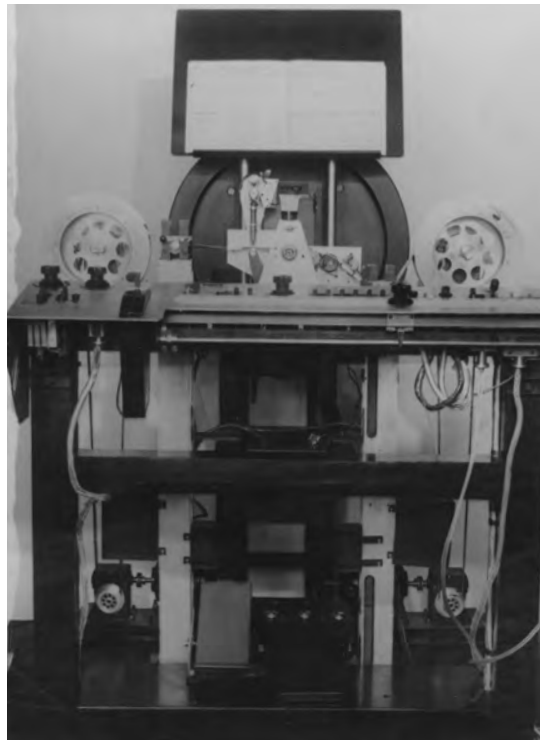
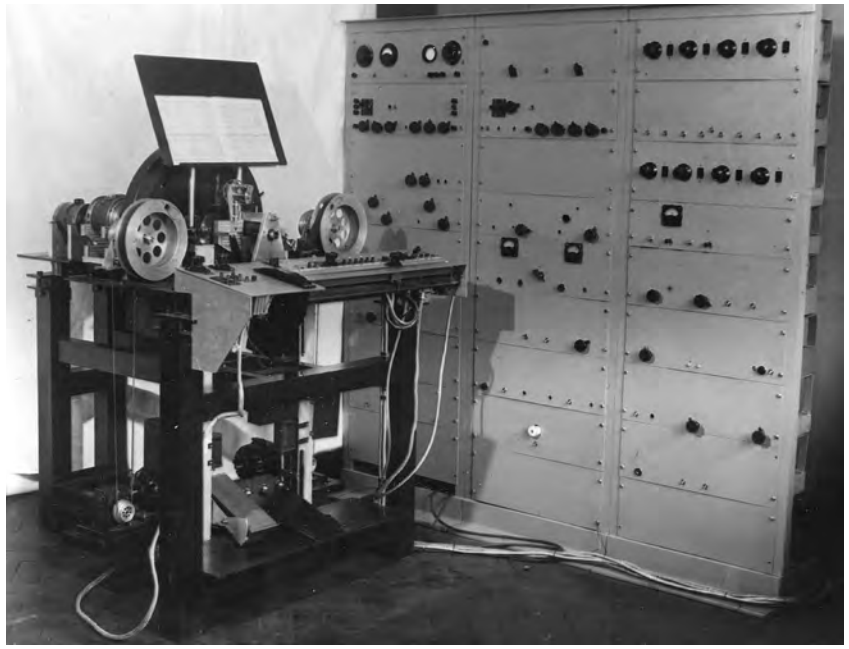


fig 7.28 The second version of the Variophone. Late 1930s. Courtesy of Marina Sholpo.

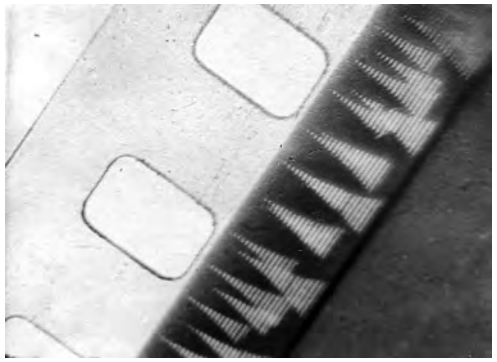


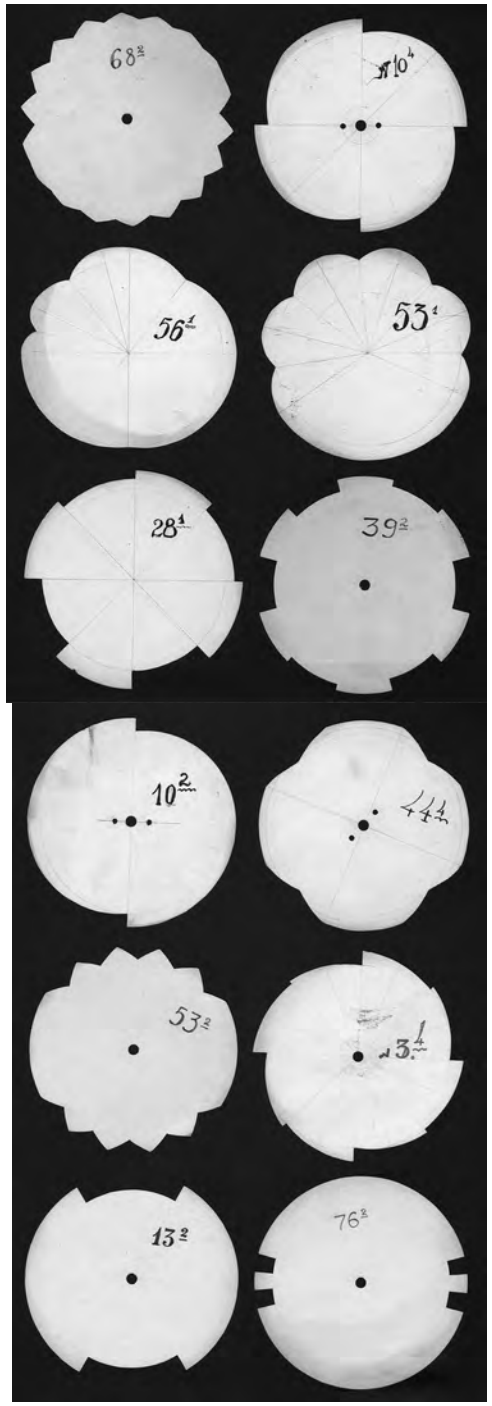


figs 7.29-30 The final, fourth version of the Variophone. Leningrad, 1949. Courtesy of Marina Sholpo.

fig 7.31 Evgeny Sholpo with his wife Olga. Leningrad, 1932. Courtesy of Marina Sholpo.

fig 7.32 Handmade 'newspaper' at the Laboratory for Graphical Sound dedicated to the International Working Women's Day, 8 March 1947. Courtesy of Marina Sholpo.





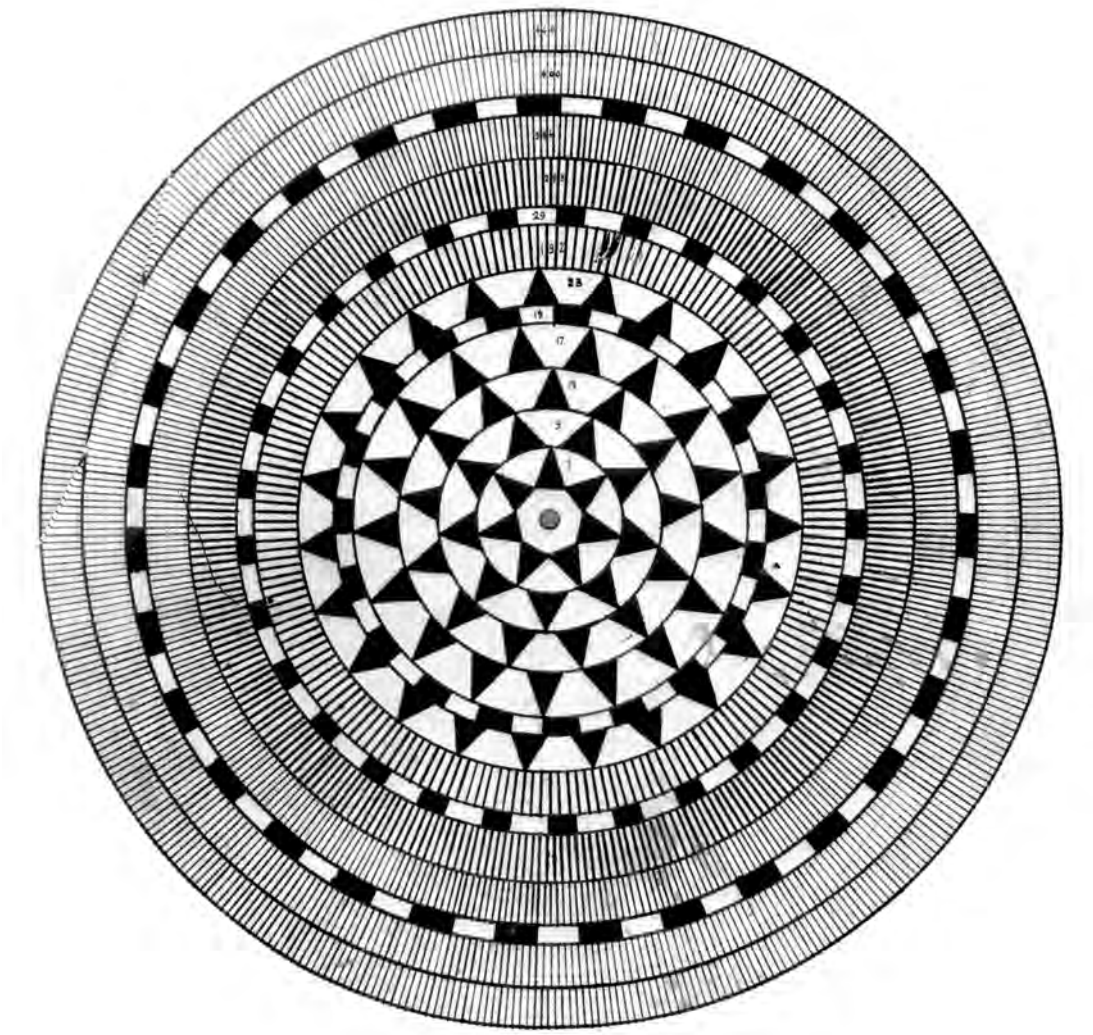


fig 7.33 Final soundtrack produced by the first version of the Variophone. Courtesy of Marina Sholpo.

fig 7.34 Optical disks for the third version of the Variophone. Courtesy of Marina Sholpo.

fig 7.35 Experimental multi-track optical disk for the last version of the Variophone. Courtesy of Marina Sholpo.

figs → final version of the Variophone he made an attempt to switch to magnetic recording instead of optical soundtracks■ (see figs **7.29-30**, **7.35**). This version was never finished since the Laboratory for Graphical Sound was finally closed in 1950. The instruments were declared as non-functional so they were discarded and thrown out.

fig 7.36 Boris Yankovsky. c. 1938. Courtesy of Marina Sholpo.

BORIS YANKOVSKY (1904-73?), painter and acoustician. In 1931-32 Yankovsky was on the staff of Avraamov's Multzvuk group. In December 1932 he wrote a proposal for a patent on his own method of sound synthesis, based on Graphical Sound techniques. In 1933 he was invited to the Mosfilm Productions Company to organize the Laboratory for Synthetic Sound Recording.

In 1935 Yankovsky joined the Autonomous Research Section (ANTES) at the Union of Composers in Moscow, and in 1936 his laboratory was passed to the NIMI institute at Moscow Conservatory.

In 1938 Boris Yankovsky met Evgeny Murzin, a young inventor fascinated by the idea of a universal tool for sound synthesis, who was to prove an invaluable collaborator.

In 1939 Boris Yankovsky and Evgeny Sholpo decided to unite their efforts and the new Laboratory for Graphical Sound was established in Leningrad. During the War Yankovsky and his family were evacuated to Alma-Ata. When he had the opportunity to move back to Moscow in 1949, he switched to research work on the acoustics of violins, working at the Experimental Factory of Musical Instruments in Moscow. Boris Yankovsky is believed to have died in 1973.

BORIS YANKOVSKY — SYNTHETIC ACOUSTICS

In 1931-32 the young painter and acoustician Boris Yankovsky was on the staff of Avraamov's Multzvuk Group. In 1932, having become disappointed by the 'ornamental sound' approach, he left the Multzvuk Group and established his own Syntonfilm Laboratory in Moscow. Unlike most of his colleagues, being a good acoustician he had a clear understanding that the ornaments and related sound waveforms did not represent uniformly the tone 'colour'. Only a dynamical spectrum of sound with all the nuances of its temporal transitions could give a complete picture. In 1935 in one of his manuscripts Yankovsky wrote:

It is important now to conquer and increase the smoothness of tone colours, flowing rainbows of spectral colours in sound, instead of monotonous colouring of stationary sounding fixed geometric figures [wave shapes], although the nature of these phenomena is not yet clear. The premises leading to the expansion of these phenomena – life inside the sound spectrum – give us the nature of the musical instruments themselves, but 'nature is the best mentor' (Leonardo da Vinci)... The new technology is moving towards the trends of musical renovation, helping us to define new ways for the Art of Music. This new technology is able to help liberate us from the cacophony of the well-tempered scale and related noises. Its name is Electro-Acoustics and it is the basis for Electro-Music and Graphical Sound.[32]

Yankovsky's approach had much in common with that of Rudolf Pfenninger. Both were primarily focused on acoustics. As Thomas Levin puts it: 'Fischinger's curves are not derived from sound, they generate it, whereas Pfenninger's curves are in the last analysis derived from the sounds that they analytically recreate... Pfenninger's curves are decidedly not ornaments but are rather, as numerous critics have rightly noted, "templates or print-types", that is, semiotic entities that can be combined to produce sounds in a linguistic — which is to say, thoroughly technical and rule-governed — manner. Unlike Fischinger's curves, which were continuous, Pfenninger's were discrete units.' [33]

Yankovsky went much further than other researchers. Of all the early Graphical Sound pioneers Yankovsky alone pursued the approach of spectral analysis, decomposition and re-synthesis. His curves were 'spectral templates', semiotic entities that could be combined to produce sound hybrids, based on a type of spectral mutation. Yankovsky wrote:

... I found the idea of synthesis while I was laboriously working on 'drawn sound'. And this is the chain of my considerations:

1 *The colour of the sound depends on the shape of the sound wave*

2 *Graphical representation of the sound wave could be analysed and represented as the Fourier series of periodic functions (sine waves)*

32 Yankovsky, B. 'Analiz i sintez tembra' (Analysis and Synthesis of Timbre) March, 1935, Moscow. Unpublished article. TCA. p. 35. Trans. AS.

33 Levin, T. 'Tones from out of Nowhere: Rudolf Pfenninger and the Archaeology of Synthetic Sound'. *Grey Room 12* (Fall 2003): p. 32-79.

3 *Consequently, the sound wave could be re-synthesized back with the same set of sine waves. Nobody did this before the invention of graphical (drawn) sound just because there were no technical means and methodology for sound reproduction from such graphical representations of sound. As with electrons (the neutrons and protons) the number of which defines the quality of the atom, so do sine waves define the quality of the sound – its timbre*

The conclusion: why not initiate a new science – synthetic acoustics?

It would make sense if we could define (at least in draft) a sort of Periodic Table of Sound Elements, like Mendeleev's Periodic Table of Chemical Elements. The system of orchestral tone colours has gaps between the rows that could be filled by means of syntheses, like the gaps in the rows of Mendeleev's Periodic Table of Elements have been filled with the latest developments in chemistry... It is obvious that the method of selection and crossing of sounds and instruments, which is similar to the method of Michurin,[34] *will give us unprecedented, novel 'fruit-hybrids' that are technically unattainable for a usual orchestra...*[35]

Yankovsky explains his methods and experiences in his manuscripts. He defined the main purposes of the research as follows:

1 realize objective study and categorization of sound spectra, related to existing musical instruments

2 explore spectral transitions in dynamically changing sounds, especially during the process of the determination of the sound mode

3 study the rhythm and temporal characteristics of live musical performance and define the methods of mathematical simulation of artistic expressiveness

4 synthesize complex timbres from the pure sine partials according to the aforementioned data

5 produce artificial phonograms and impose them on film

6 achieve independent control over the pitch, volume, duration and tone colour

7 achieve independent control over the spectral content and formants

8 develop techniques to produce a seventy-two-steps-per-octave pitch scale

9 develop a special tool for the total automation of the sound production process.[36]

AUDIO COMPUTING

Boris Yankovsky proposed the method, based on research into structural similarities and distinctions among spectra of sounds of different character, to limit as far as possible the number of calculations needed for the additive synthesis of various complex sounds. In order to achieve this he decided to:

1 analyse the spectra of various sounds

2 derive information about their structure in relation to the character of sound

3 divide all sounds into classes according to common features of timbres, related to spectra and spectral dynamics

4 analyse these common features (formants, for example)

5 divide the spectrum into groups of overtones responsible for the specific character of the timbre

6 calculate and draw the waveforms related to these spectral groups

7 build a library of drawn waveforms for further manipulation within the framework of various synthesis tasks

Yankovsky named these final drawn waveforms 'spectro-standards' or 'spectral templates'. He expected that by combining and mixing these waveforms one would be able to synthesize almost any desirable sound. Thus, according to Yankovsky, for the final stage of sound synthesis there is no need to deal with spectra but rather to manipulate the predefined waveforms — the readymade templates — selecting them from the library. These templates could be modified by changing their sizes by optical means (or mathematically and graphically) according to calculated desirable amplitudes and frequencies, mixing the results optically or by means of mathematical calculation of the final waveform.

The method developed by Yankovsky was based on pure audio computing techniques and possessed properties very common in digital technologies, such as discretization and quantization of audio signals and related spectral data, manipulation with ready-made parts, and operations with selections from databases of the basic primitives (templates), that distin-

34 Ivan Michurin — the famous Russian biologist-horticulturist.

35 Yankovsky, B. 'The Theory and Practice of Graphical Sound. Acoustical Syntheses of Musical Colours', Leningrad, 1932-1940, Unpublished manuscript. TCA. p.15, 45. Trans. AS.

36 Yankovsky, B. 1939-40. 'The Theory and Practice of Graphical Sound. Acoustical Syntheses of Musical Colours', Leningrad, 1932-40. Unpublished manuscript. TCA.

guish it from the methods of analogue signal processing. It can be considered as a sort of proto-computer for music techniques with many of the typical features of modern digital technology for sound and music computing.

To perform complex mathematical calculations of waveforms as well as other important parameters of sound and automated musical performance such as rhythm, there were special 'employee-computers' on the staff in the laboratories of Boris Yankovsky and Evgeny Sholpo. These were mathematicians whose specific task was to make calculations.

Yankovsky's practical approaches were based on: the analysis of descriptions of spectra available in literature; occasional opportunities to use the spectrum analyser at the First Factory of Bow Instruments in Moscow; and practical experience, which gave Yankovsky the possibility of estimating the spectral content of sounds by exploring the structure of the waveform. Yankovsky noticed that sharp resonances incorporate quite obvious periodic patterns into their waveforms. Measuring the frequency and relative amplitude of these patterns by means of a special ruler, he could give a rough estimate of the formant structure of sound.

As a result of his long-term research Yankovsky established that all natural sounds can be divided into classes with corresponding characteristic types of spectra and acoustic properties of sources, according to:

1 specific features of the spectral content of a sound (e.g. the predominance of even or odd overtones etc.)

2 presence of formants, reflecting the resonant properties of the sound source

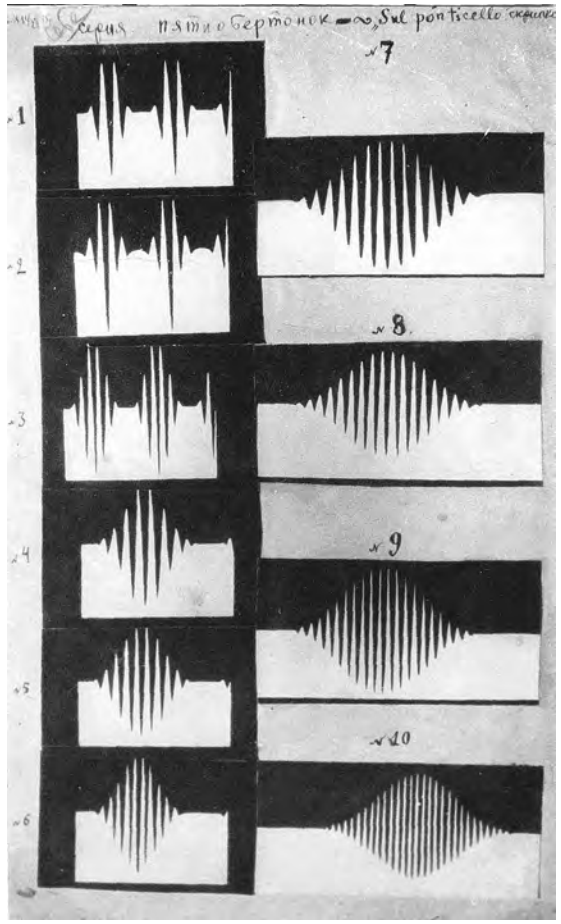
3 features of transients in a spectrum, especially during the sound attack

4 specific amplitude envelopes (attacks and decays)

5 specific amplitude and spectral modulations (e.g. various forms of vibrato).

He also found out that within the boundaries of one class it is possible to allocate properties that are common for other classes. Yankovsky considered the common formant the most important shared feature of different sounds within one class. In the series of syntones called the 'Pentaovertones' Yankovsky made an attempt to synthesize narrow band spectra, reminiscent of single sharp formants.■ His idea was to calculate waveforms related to sets of five high-order overtones, grouped around some particular middle frequency with missed low-order overtones, including the first harmonic. His expectation was that splicing together calculated fined length, would permit him to synthesize sounds with different pitches, depending on the duration of the intermediate silent pause, while the frequency of the formant would be fixed and equal to the above-mentioned middle frequency. In fact the waveform for the whole period including the intermediate segment should be calculated according to the spectrum desired. Nevertheless even in the case of the silent pause the idea is still valid: on the spectrogram the strong

fig 7.37



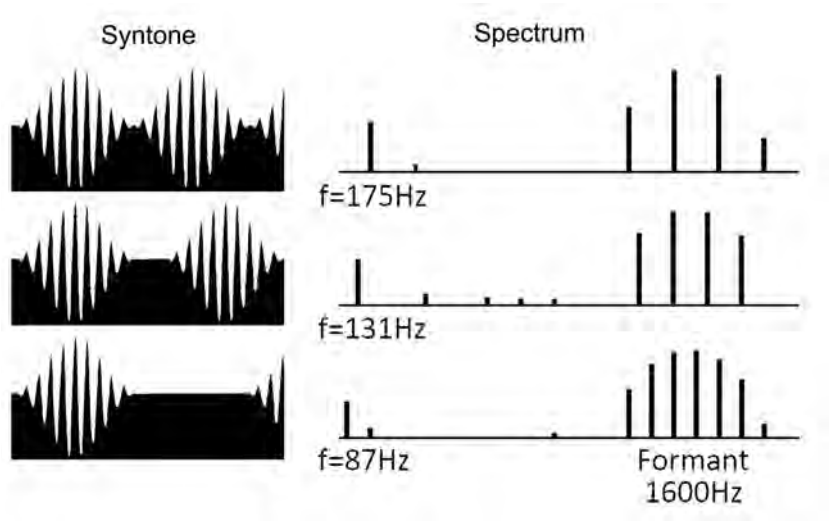


fig 7.37 Mathematically calculated Pentaovertones. 1933-35. TCA.

fig 7.38 Example of pitch transposition keeping the formants fixed, based on the Pentaovertone syntone, with related waveforms and spectrograms. Diagram by A. Smirnov.

fixed formant can be seen, independent of pitch, while the spectral content depends on the basic frequency, although the number of overtones also depends on the basic frequency and in most cases is not equal to five.■ This idea gives the possibility of varying the pitch as well as constructing complex formant structures independent of pitch with the minimum of calculations. Experimenting with optically recorded sounds, Yankovsky noted that transposing them up and down by means of varying the playback speed destroys the character of the sound. According to Yankovsky's analysis: 'The formant of sound, if it is possible only to speak about the formant in this particular case, and most precisely the whole fixed structure of overtones, moves in parallel to the fundamental frequency along the whole range of transposition.'[37]

fig 7.38

To solve the problem of pitch transposition keeping the formants fixed to preserve the character of a sound, Yankovsky suggested calculating three templates per octave for the whole pitch range of each particular sound, transposing each template by means of varying the playback speed in the range not exceeding one third of an octave. He recollected:

Once, synthesizing spectral templates based on the formant of the vowel "a", I found their similarity to the waveforms of optically recorded woodwinds in their high registers. In other words, the formants in their high registers differed, apparently, only by one frequency zone, not exceeding an interval of a small third... To keep the sound character constant it is necessary to synthesize a series of templates possessing the common formant for different pitches, so that the loudest overtones would be located in the same frequency zone... The question is of the quantity of notes in a range of the instrument for which it is necessary to synthesize spectral templates... I planned to synthesize three templates per octave of each timbre. Certainly, it was a compromise in relation to the requirement of absolute stability of the formant... but in practice this shift was absolutely unnoticeable.[38]

SYNTONES AND SYNTHETIC INSTRUMENTS

According to Yankovsky's classification he was working with four basic levels of spectral organization, related to his specific method:

1 'Simple (or 'pure') tone' — harmonic vibration, based on a sine law

2 'Complex tone' — the superposition of several simple tones

3 'Syntone' (synthetic tone) — artificial complex tone, based on the mathematical addition of simple tones related to some particular spectral template and created by means of Graphical Sound techniques

4 'Synthetic Instruments' — the library of Syntones, related to some particular sound character (instrument) with fixed formants, intended for music creation, based on Graphical Sound techniques. It has nothing in common with ordinary 'musical instruments' played by hands and fingers.[39]

The purpose of his research was:

'...to fill the gaps between orchestral sounds by means of developing new types of intermediate tone colour production, for example by the following technical methods of making the transition between two sounds:

1 *by slow fade-ins and -outs, spectral transitions with double photo-exposure*

2 *by quick, spectral flowing – with amplitude vibrato shifted on half-cycle with maximums of power of the one sound in between maximums of the other*

3 *reproduction of any sound colour dependent on dynamical changes of both the amplitude and the waveform of the regular vibration, such as pizzicato and the soft attack of sound, volume vibrato, and different transitional processes in the beginnings of sounds and in the transitions between them, typical of all existing ways to elicit sound from most musical instruments'* [40]

For example, to synthesize the human voice singing a vowel, one would need to choose several templates related to formants (drawn waveforms similar to Pentaovertones), to add extra templates as needed (such as 'equal-amplitude complete'), to recalculate their sizes according to the desirable frequencies and intensities of formants, and then to mix them. The final waveform would sound like a 'frozen' vowel.[41] This waveform could be used to produce a temporal 'quant' of sound, physically related to one frame of the film. To produce the sound, dynamically changing in time, one would have to calculate the sequence of static frames, in which each frame represents the successive state of changing timbre. In order to produce the final soundtrack one would have to cross-fade successive overlapping frames by optical means to achieve smooth transitions and to avoid clicks. Yankovsky developed his Vibroexponator to realize this process in a single tool.

37 Yankovsky, B. 'Teoriya I praktika graficheskogo zvuka. Akusticheskiy sintez muzikalnih krasok' (The Theory and Practice of Graphical Sound. Acoustical Syntheses of Musical Colours), Leningrad, 1932-1940, Unpublished manuscript. TCA. S. 71.1. Trans. AS.

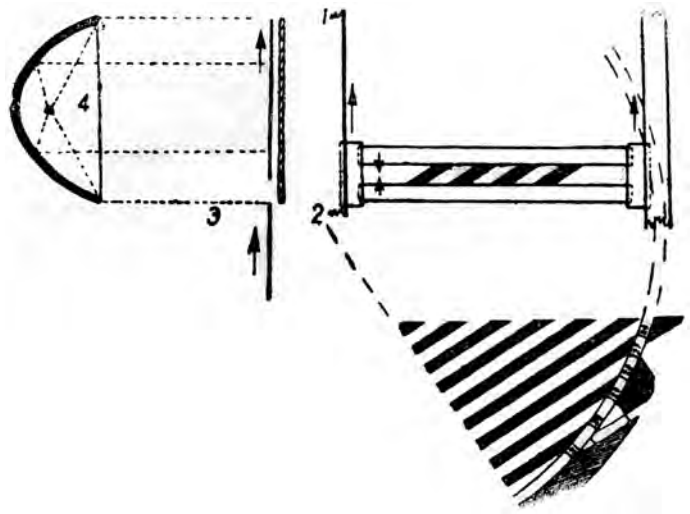
38 *Ibid*. S. 71.2

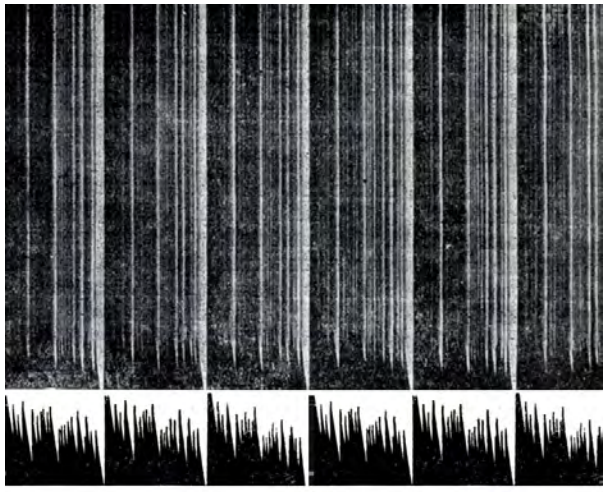
39 *Ibid*. S. 68

40 *Ibid*. S. 38

41 Smirnov, A. 'Synthesized Voices of the Revolutionary Utopia'. In *Electrified Voices*, Dmitri Zakharine and Nils Meise (Eds.), Universität Konstanz, Germany, 2011 / V&R unipress, 2012, pp.163-185.

fig 7.39 ‘Employee-computers’ at the Laboratory for Graphical Sound. Leningrad, 1946. Courtesy of Marina Sholpo.





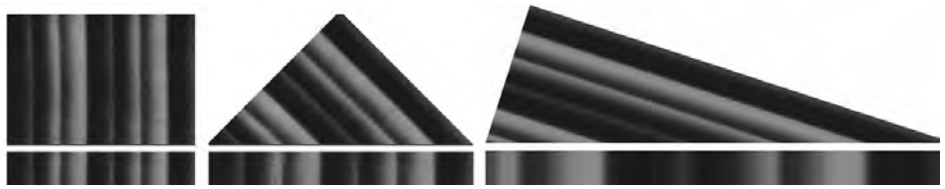


fig 7.40 A part of the construction of the Vibroexponator. From the book *Multiplikacionni film*, Kinofotoizdat, Moscow, 1936. AS library.

fig 7.41 The first intensive soundtracks, produced by Yankovsky in 1933. From the book *Multiplikacionni film*, Kinofotoizdat, Moscow, 1936. AS library.

fig 7.42 The results of slide copying. From the book *Multiplikacionni film*, Kinofotoizdat, Moscow, 1936. AS library.

fig 7.43 The way to shift the pitch down. Diagram by A. Smirnov.

THE VIBROEXPONATOR — HOW IT WORKS

From the start Yankovsky intended to work with a modified animation stand called the Vibroexponator, shooting still images of artificial drawn sound waves by means of a rostrum camera. This meant that the discretization of time scale was predetermined by twenty-four frames per second, with each successive frame containing one stable sample — a sort of momentary photograph of the constantly changing sound. The audio waveform of each successive frame was calculated according to the spectral content, based on the specific set of spectral templates he had devised.

Although Yankovsky referred to the construction of the Vibroexponator in several articles he never described it in all its details. Nor have any detailed drawings of its construction yet been found. Nevertheless, according to existing descriptions, the Vibroexponator had several stages that enabled the whole process of syntone production as well as the creation of the final soundtrack, related to one frame.

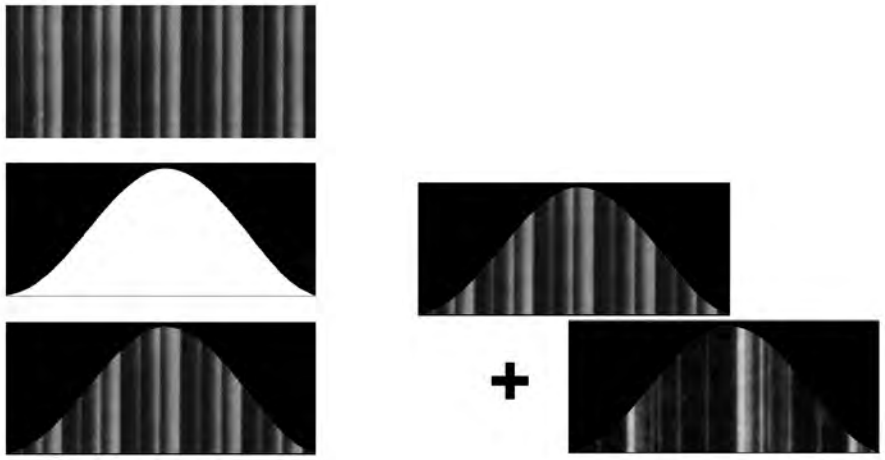
A crucial part of the Vibroexponator was the slide-copying machine tool devised to convert the initial 'transversal' optical soundtrack (produced by pure drawn methods based on mathematical calculations of the spectral templates) into the 'intensive' form necessary for further processing. To produce the slide-copying process a film was placed in the mount of the copying cassette with a thin aperture located along the film enabling light to pass through onto the photographic plate behind. An extended variable density image of the original transversal waveform was produced by dragging the cassette down in front of the unexposed photographic plate.

The 'intensive' (variable density) image of the sound waveform could then be used to produce new waveforms related to different lower pitches of the sound. To achieve this, the photo plate with variable density waveform needed to be mounted behind another thin aperture, rotated according to the scale with precisely calculated angles of rotation related to desirable pitch shift. Further film was then exposed using this aperture.

The rotation of the original had the effect of stretching the waveform without changing any of its relative characteristics. This part of the Vibroexponator was called the 'Syntone Exponator'.

The Vibroexponator was mounted as an extension of a rostrum camera. This way, successive frames of film could be exposed to build spectral transformations by incremental changes in pre-synthesized waveforms, each increment being one frame of film. The change in sound was enabled by cross-fades between successive frames. Each frame was faded into the next to make edits in the sound less audible. This was realized in two ways, the first of which involved defocusing towards the edges of each frame, creating a blurring, or smoothing of the waveform, the second processing each frame with a bell-like amplitude envelope, based on one period of the sine wave, by means of a special mask located in the top part of the Vibroexponator.

Another part of the Vibroexponator incorporated a special multi-segment mask to produce fast envelopes with discretization, equal to three steps per frame, to produce amplitude and spectral vibrato. The final processing included using the top part of the Vibroexponator to produce slow envelopes for cross-fades between two different syntones.



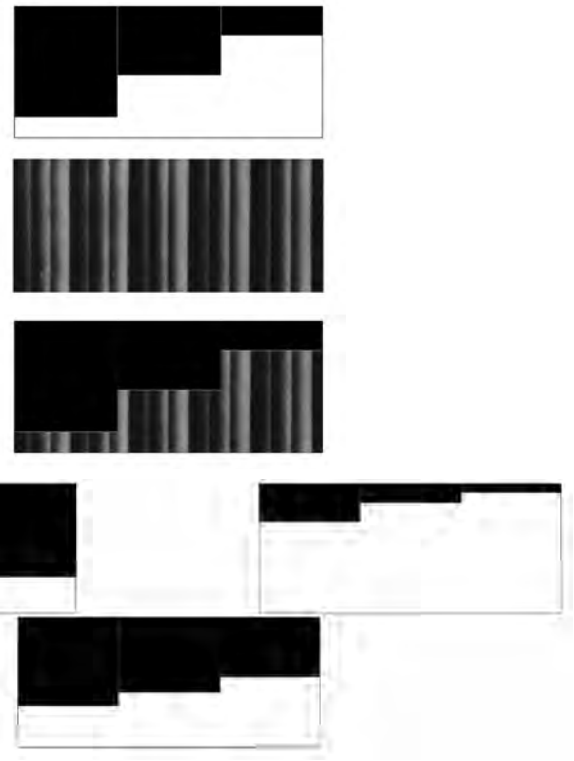


fig 7.44 A bell-like mask to create an amplitude envelope (left) and the way to crossfade successive frames (right). Diagram by A. Smirnov.

fig 7.45 A multi-segment mask (above) and the method for using it to produce slow fades (below). Diagram by A. Smirnov.

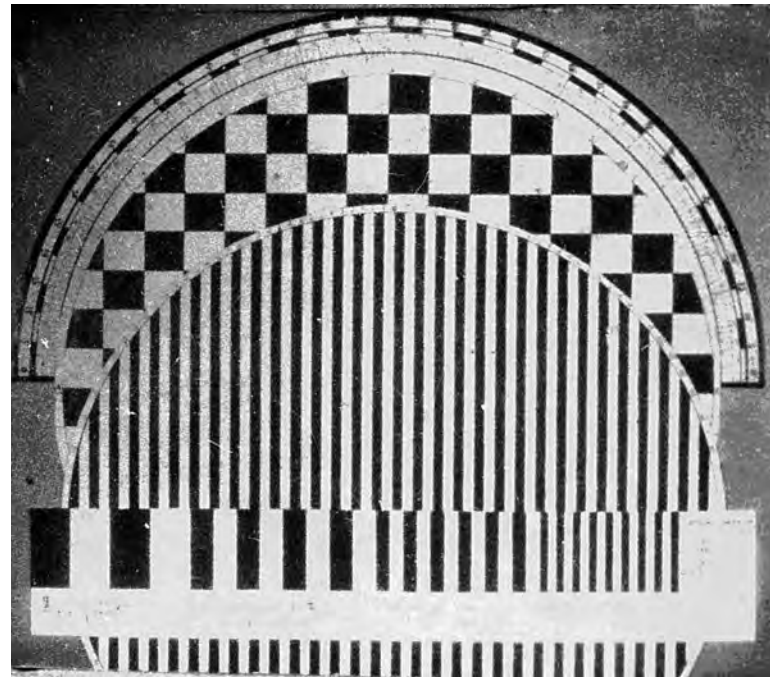


fig 7.46 Scale with precisely calculated angles of rotation related to desirable pitch shift. TCA.

To manipulate the dimensions of the image of the initial 'transversal' soundtrack, related to the pitch and amplitude (for example, to double the pitch), different optical methods were utilized, including the Anamorphot optical tool, based on an anamorphic lens system that was developed at the Leningrad Institute for Precise Mechanics and Optics in response to Yankovsky's idea.

In December 1932 Yankovsky wrote a proposal for a patent on a method related to his main tool the Vibroexponator, based on a modified animation stand. On 29 March 1933 he received a 'certificate of primacy' (#126248) for the application 'Ustroystvo Zvukovoy Multiplicacii' (Device for Sound Animation)[42] which, according to the official bulletin, had the author's certificate #34195. Owing to a typographical error somewhere along the line, this in fact belonged to a different Application No. 126284.[43] It was a mistake of just one digit. The result of this error was that Yankovsky's application was lost and never mentioned again.

ACHIEVEMENTS BY 1940 AND FUTURE PROSPECTS

In 1933 Yankovsky was invited to the Mosfilm Studios to organize the Laboratory for Synthetic Sound Recording where in 1934-35 he recorded a sizeable collection of samples of instruments from the Symphony Orchestra of the Bolshoy Theatre. By 1936 the collection of 110 synthesized templates — syntones — had been created.■

fig 7.48

42 'Ustroystvo Zvukovoy Multiplicacii', *Vestnik Komiteta po delam izobreteniy.* No. 2, 1933.

43 *Vestnik Komiteta po delam izobreteniy.* No. 5, 1934, p.46.

In 1938, during his experiments with violins at the First Factory of Bow Instruments in Moscow, Yankovsky had the opportunity to work with the new western spectrometer (the first one imported to the USSR) to check his theoretical conclusions. According to his estimations, he had produced and collected hundreds of spectra.

In 1935 Yankovsky joined the Autonomous Research Section (ANTES) at the Union of Composers in Moscow, founded by Boris Krasin, Arseny Avraamov and Alexei Ogolevets. As previously mentioned, after the death of Krasin in 1936 ANTES was closed and the Ministry of Culture stopped funding Yankovsky's laboratory. It was passed to the NIMI Institute at Moscow State Conservatory. In 1937 the young NIMI employee, inventor Andrei Volodin developed and built the electronic part — audio amplifiers — of the Vibroexponator and Yankovsky finally, after six years of research, got his syntones sounding.

In January 1939 Nikolai Garbuzov, head of the NIMI Institute at Moscow State Conservatory, sent the researcher Nikolai Zimin to Yankovsky's laboratory to check the state of developments. In his notes 'About the Laboratory for Synthetic Sound' Zimin wrote:

The Vibroexponator is a complex, bulky tool for the optical recording of synthetic sounds to the sound track of ordinary 35 mm film by means of specially produced intensive negatives. The instrument is partly mechanized and provides various motions to the original negative. The automation of the direction control is partially broken and requires extra repairs and maintenance...

The slide-copying tool is intended for production of intensive negatives from films with transversal soundtracks. It is a massive construction as well. The gearbox has at least a 100-fold safety factor and a greater power...

As auxiliary material there are several dozen films with a length of 0.5 m each, with multiple periods of synthetic sound curves. In this category there are also about several dozen films with defects. The most ingenious negatives of sound curves adapted to work in the Vibroexponator are big square variable density photo plates and are collected in special albums. As a final result there are about one hundred 35 mm films of lengths from 1.5 up to 20 m. The shorter films are glued together in long infinite loops with a length of about 20 m. Several of them were played by Yankovsky, including the clarinet, trombone, nose-like, equal-amplitude complete, equal-amplitude unclear [44], transformations between sounds and special timbres with the addition of high formants. The sound quality as such is not the best and can be significantly improved.[45]

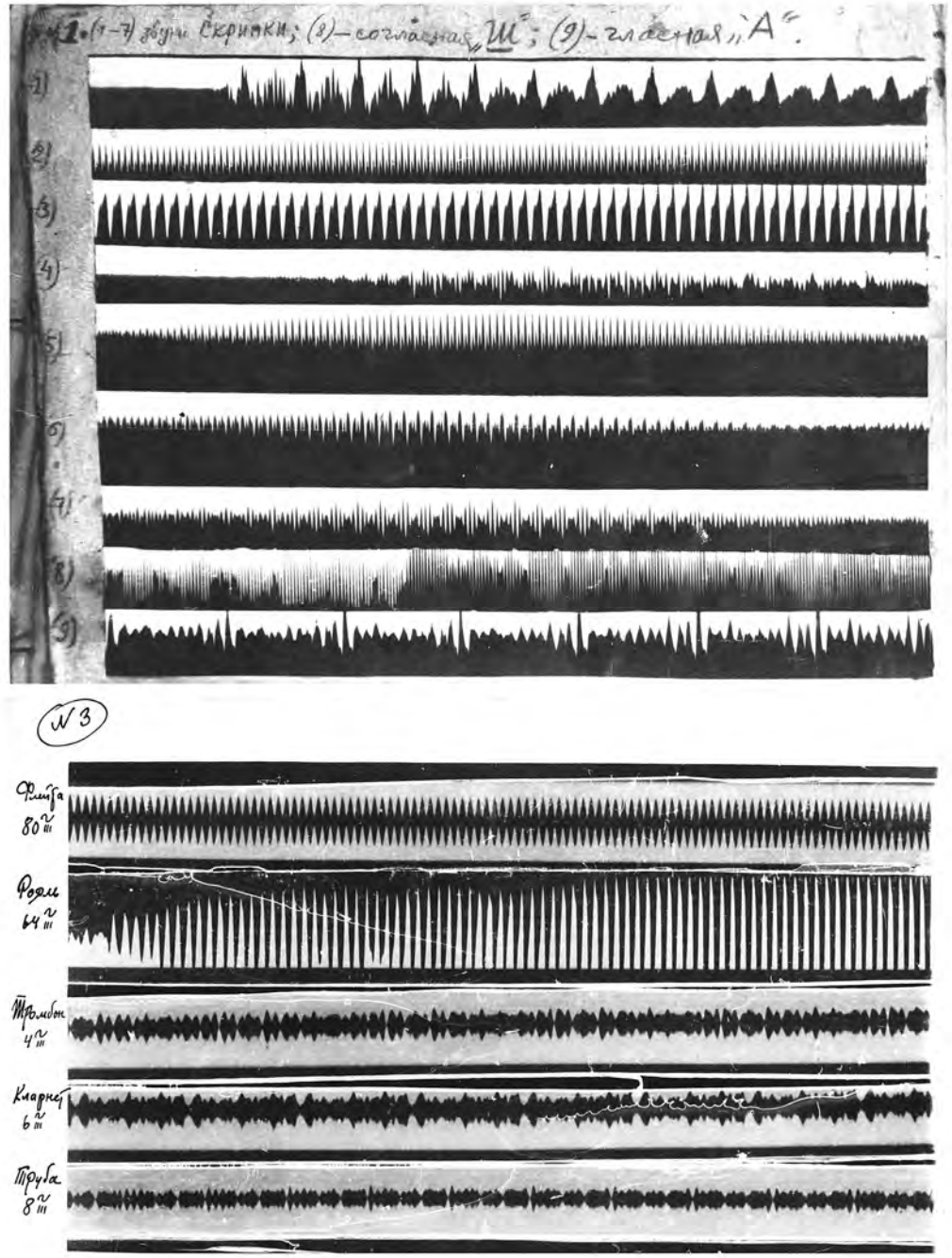
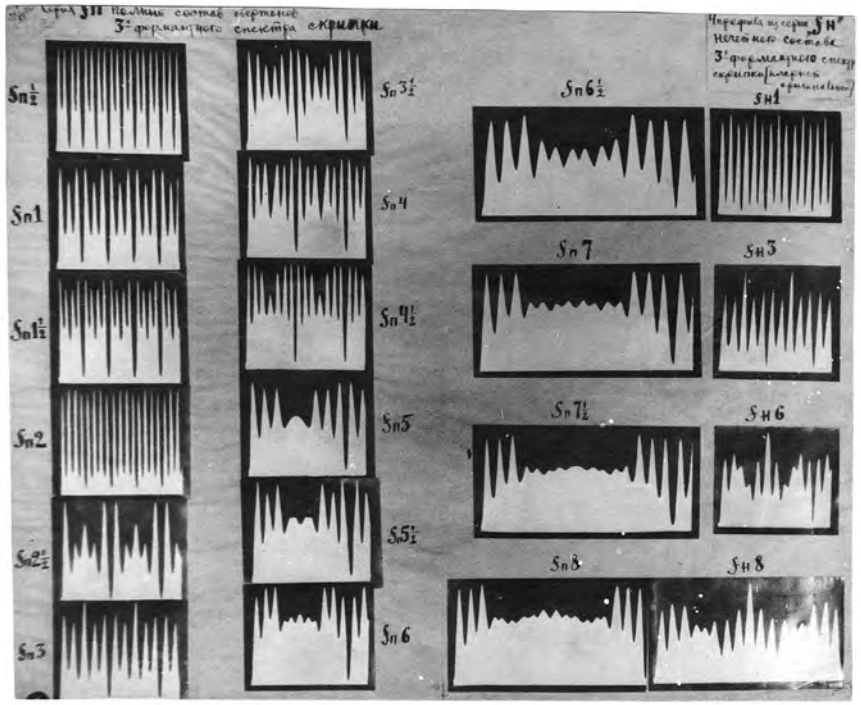


fig 7.47 (Both images) Collection of sound samples, recorded with the Kinap system. c. 1935. TCA.

44 Yankovsky's terminology refers to the common spectral characteristics of some classes of sounds. 'Clarinet' means the class of spectra with dominant odd overtones; 'trombone' and 'nose-like' are classes of spectra with some specific formants; 'equal-amplitude complete' means spectra based on complete sets of overtones (including both odd and even harmonics) with equal amplitudes; 'equal-amplitude unclear' means spectra with some missed overtones. The remaining overtones have equal amplitudes.

45 Zimin, P.N. 'About the Laboratory for Synthetic Sound', Notes for the head of the Acoustical Laboratory at Moscow State Conservatory, Professor Garbuzov. Moscow, 8 January 1939. TCA. Trans. AS.



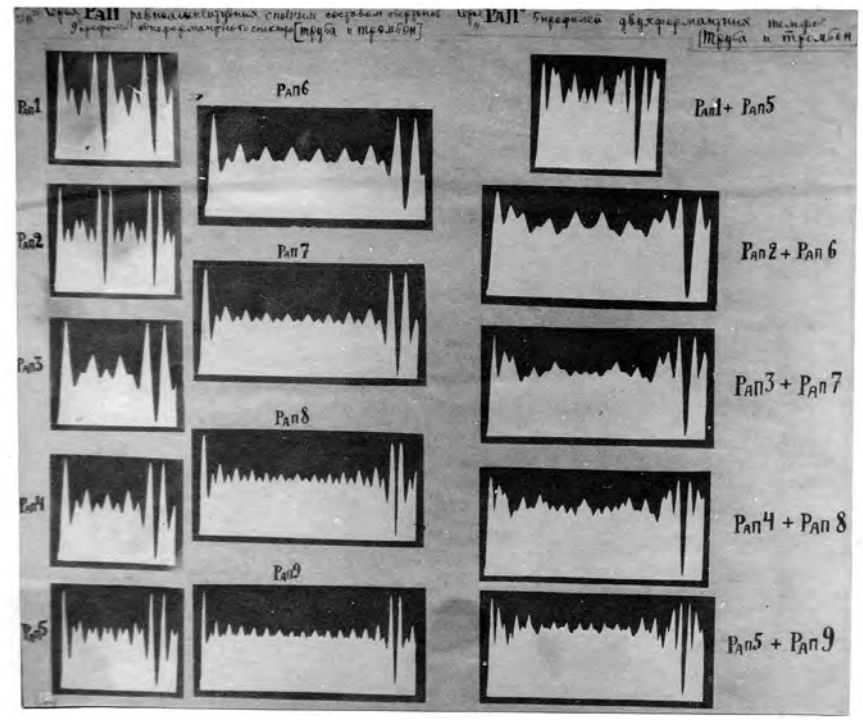


fig 7.48 (Both images) Collection of different Syntones. TCA.

As options Yankovsky developed several sound-processing techniques including pitch shifting and time stretching. In 1935 after the first screening of the new film *Gulliver*[46] the theorist and critic Sergei Boguslavsky noted that the method of pitch shifting utilized in the film affects the timbre. He wrote: 'This method of pitch transposition is harmful for the purity and safety of the orchestral timbre. We assume that the method of graphical sound developed by B. Yankovsky could be more reasonable as it allows the transposition of the whole texture on the interval over three semitones with the preservation of all timbres.'[47]

Yankovsky's method, utilized for time stretching, was mentioned by Vladimir Solev: 'After long, intensive work on the analysis of natural phonograms conducted at the Scientific Research Laboratory at Mosfilm, a problem with time stretching sounds, or on the contrary, with the multiplication of very short sounds (like some consonants) was encountered. Herein it is possible to develop analysis and synthesis based on pure drawn sound techniques as well as to apply acoustical approaches that have been discussed in the European press. The problem of timbre distortions can now be solved by Yankovsky's method of time stretching, using the so-called "optimal timbrogram"[48] which preserves the timbre of the sound.'[49]

In the early 1930s Yankovsky proposed his method based on the separation of pitch-defining spectral content and formants of sound, leading to independent control over the pitch and duration of sound on a spectral level, resembling the popular recent computer music techniques of cross synthesis and the phase vocoder.

Describing future prospects, Yankovsky wrote: 'In the future we hope to increase by eight times the width of the effective soundtrack recorded on film by drawing parallel tracks to extend the dynamic range of the phonogram as well as to achieve complicated spatial effects, locating different groups of instruments independently at different loudspeakers, producing effects of interaction of voices and sounds located in different parts of the concert hall (theatre). We also hope to construct in the future the "Synthesizer" — a huge device for the mechanical addition and simultaneous drawing of complex harmonious fluctuations.'[50]

In January 1939 Yankovsky and Sholpo decided to unite their efforts and the new Laboratory for Graphical Sound was established in Leningrad. The main activities of the laboratory were focused on the recording of new syntone-based synthetic instruments. Yankovsky moved to Leningrad where he was provided with accommodation by the Institute of Theatre and Film. He expected to complete the final version of his Vibroexponator in 1940 but his work was curtailed by World War II.

46 The film is based on the story *Gulliver's Travels* by Jonathan Swift. In the film, the voices of the Lilliputians and sounds of the orchestra were processed by means of faster playback of prerecorded phonograms.

47 Boguslavsky, S. 'Udachny Opit' (Successful Experiment), *Kino*, 22 March 1935. Trans. AS.

48 'Optimal timbrogram' is the term used by Yankovsky. It refers to the set of spectral templates taking into account the formant structure of sound.

49 Solev, V. 'Syntheticheskiy Zvuk' (Synthetic Sound), *Kino*, July, 31, 1935, p.4. Trans. AS.

50 Yankovsky, B. 'The Theory and Practice of Graphical Sound. Acoustical Syntheses of Musical Colours', Leningrad, 1932-40. Unpublished manuscript. TCA. p.40-41. Trans. AS.

During the war Yankovsky and his family were evacuated to Alma-Ata (over 4,000 kilometres from both Moscow and Leningrad), and he lost his right to an apartment in Leningrad. In 1946 Sholpo was trying to find a way for Yankovsky to return and join the Laboratory. Many official papers were written and letters sent without success.

When Yankovsky found an opportunity to move back to Moscow in 1949, he switched to scientific research work on the acoustics of violins. Working at the Experimental Factory of Bow Musical Instruments, Yankovsky was trying to find objective, scientific bases for violin production. He was awarded several patents and wrote numerous articles. But the history of Graphical Sound was almost forgotten. In the era of analogue synthesis and magnetic tape recording nobody was interested in 'old-fashioned' technology.

Fortunately Yankovsky kept his unpublished manuscripts as well as a box with his synthetic tone-films. In the late 1960s, visiting Moscow State Conservatory, Yankovsky met the young sound engineer Lev Bolotsky — possibly the only person to take his ideas on Graphical Sound synthesis seriously, and it was for this reason that he donated his old manuscripts and invited Bolotsky to his laboratory. Bolotsky remembers that Yankovsky showed him a large cardboard box full of tone-films and photo-plates. This was sometime around 1970. Nobody knows what later happened to this collection. Hopefully the treasure is still awaiting the fortunate researcher. Boris Yankovsky is thought to have died in 1973.

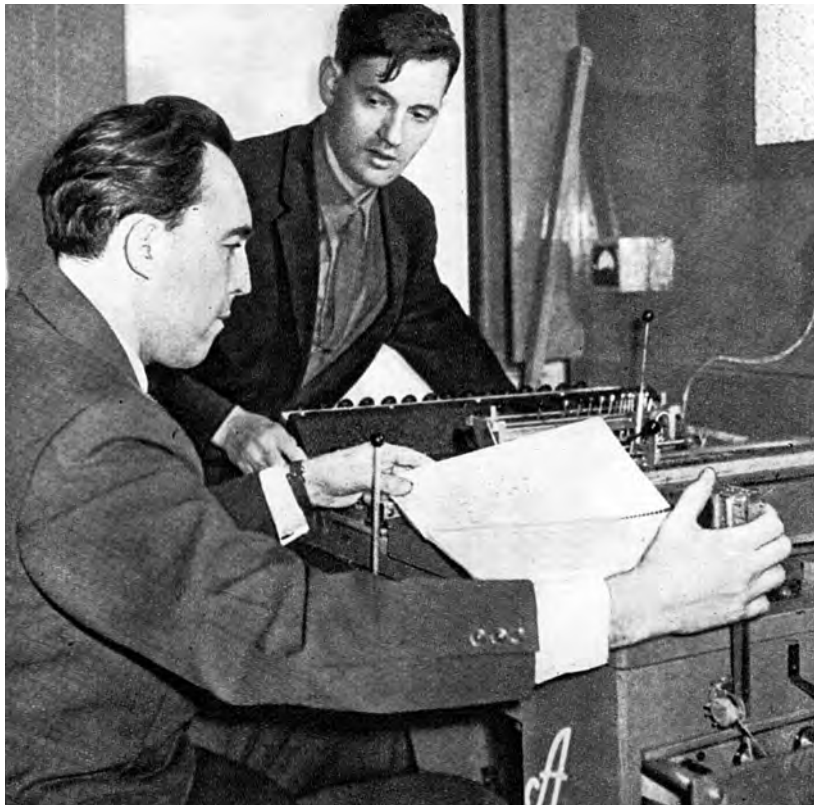


fig 7.49 Evgeny Murzin (right) and Nikolai Nikolsky working with the first version of the ANS Synthesizer. Moscow, 1960. Journal *Znanie sila*, N.3, Moscow, 1960, p.30. AS library.

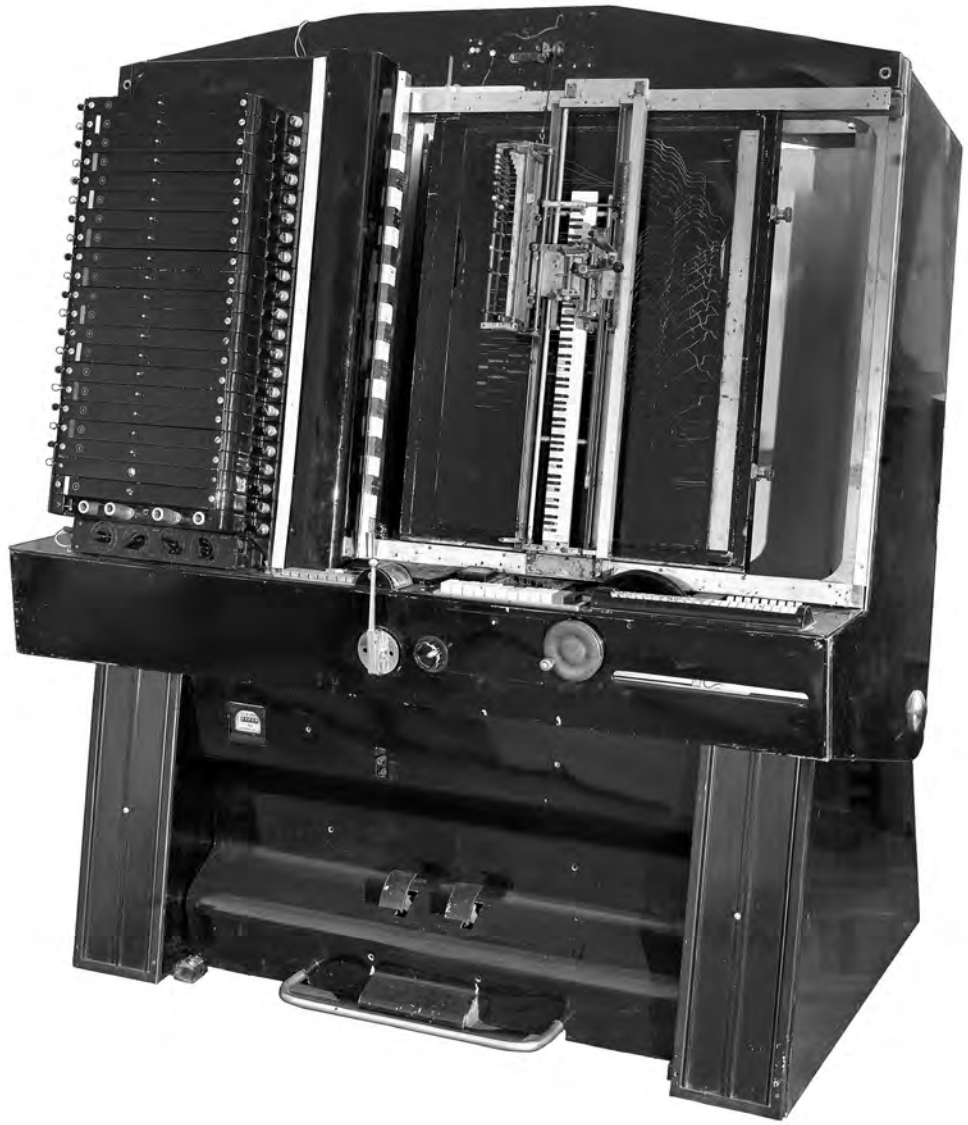
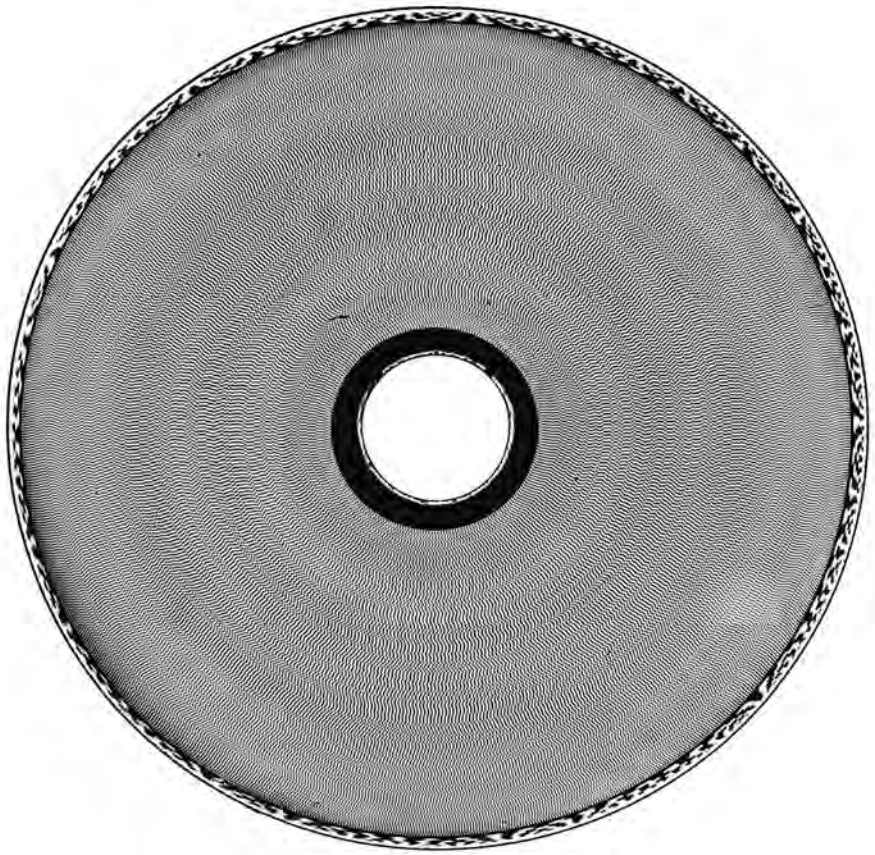


fig 7.50 The second version of the ANS. Moscow, 1967. TCA.



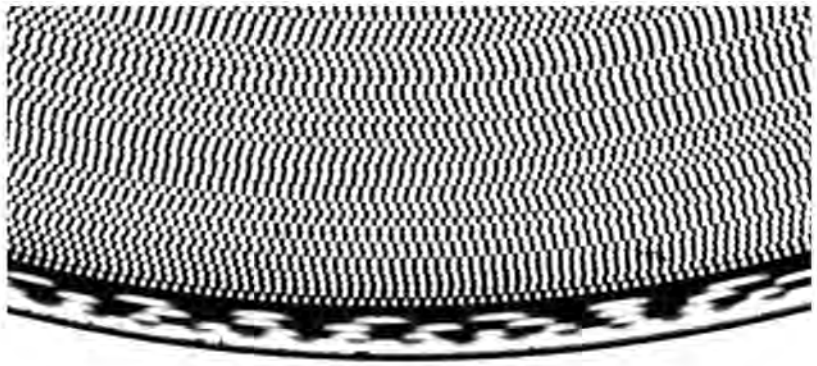


fig 7.51 (Both images) Optical disk for the ANS Synthesizer. Curiously, the size of the optical disk, developed by Murzin in the late 1930s, was exactly the same as a modern CD. TCA.

THE ANS SYNTHESIZER

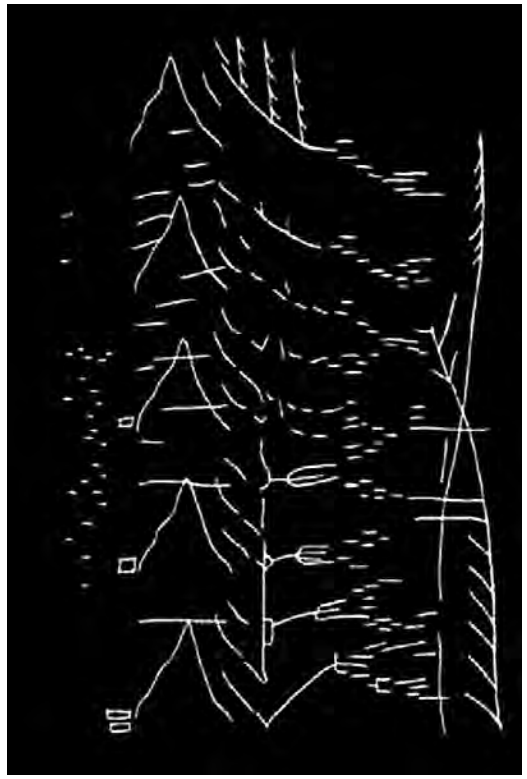
In 1938 Yankovsky met Evgeny Murzin (1914-70), a young inventor fascinated by the idea of a universal tool for sound synthesis. (See also p.234.) By 1939 the concept of the instrument had been developed and in 1957 Murzin completed the development and patented[51] a photo-electronic musical instrument called the ANS Synthesizer. (Its name was derived from the initials of influential composer Alexander Nikolayevich Scriabin.) It was remarkably close to the concept of Evgeny Sholpo's Mechanical Orchestra. The instrument was based on a set of optical sine wave oscillators, adjusted on fixed frequencies, forming a diskrete scale, covering the whole audible range with intervals between successive pitches unperceivable by the human ear. Control over the system and the process of sound synthesis was carried out by means of a special graphical score with the diagram, representing a spectrum of a sound by means of drawn transparent strips, having appropriate shape and slopes, allowing the full set of sine wave tones to be operated synchronously and independently, controlling the sound on a spectral level, directly manipulating the overtones, and erasing the difference between the pitch harmony structures and the spectral tissue of a sound.

In fact the ANS Synthesizer is based on the same principles of photo-optical sound recording — used in cinematography — as the Variophone by Evgeny Sholpo. It incorporates a set of rotating optical disks with photo-printed round optical sound tracks. While in the Variophone one rotating disk produced a single sound, in the ANS each optical disk contained 144 independent sound tracks. Four disks, used in the first version of the instrument, could produce simultaneously 576 sine waves with frequencies covering the whole audible range with accuracy of seventy-two steps per octave (the scale proposed by Yankovsky). This number of pure tones makes it possible to obtain a smooth variance of pitch. The minimum interval is 1/72 of an octave, or 1/6 of a semitone, which is only just perceptible to the ear. Such precise gradation of the pitch makes it possible to synthesize a greater number of pitch divisions per octave than the traditional Western musical scale's twelve semitones. The second version of the ANS was constructed in 1964 and generates 720 tones covering the entire audible frequency range. Unlike the Variophone, intended to produce optical recording of sound on film as a result of a non-realtime process, ANS was a realtime instrument, producing the sounding result directly during work.

Conceptually the instrument develops Boris Yankovsky's ideas: working with the ANS Synthesizer the composer manipulates the spectrum of sound instead of the waveform. Murzin did, however, develop a unique musical interface — the graphical score.■ Working with the ANS the composer etched a sonogram — a dynamical spectrum of sound development in time — onto a large sheet of glass covered with a tar-like non-drying mastic. The glass is then cranked (by hand or by motor) across the light beams. Scraping off a part of the mastic at a specific point on the plate allows light from the corresponding optic phonogram

figs 7.52, 7.55

51 Murzin, E. 'Photoelectrichesky sintezator muziki' (The Photoelectric Synthesizer of Music). Copyright Certificate No. 118 695, USSR, applied for 24.06.1957.



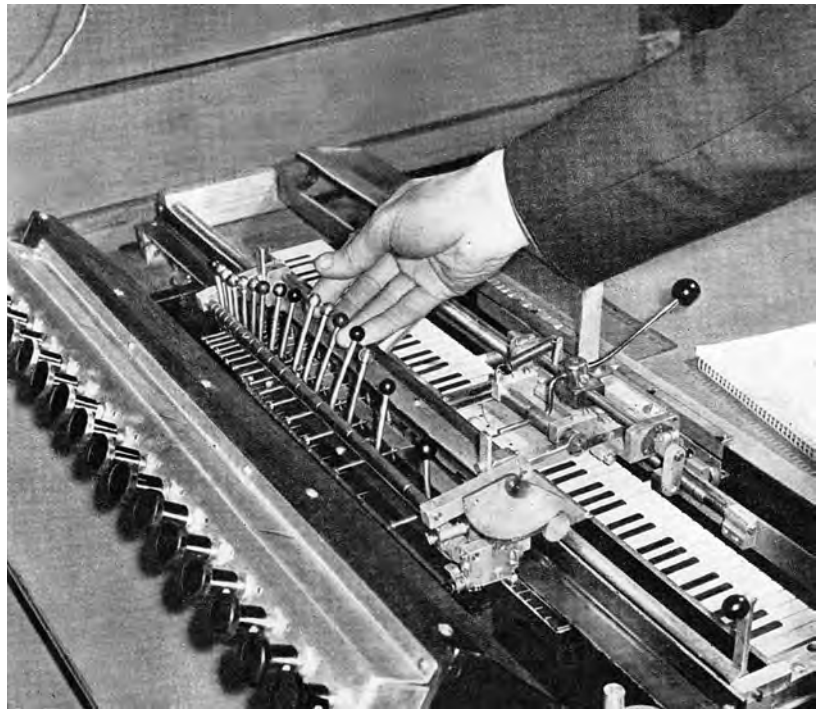


fig 7.52 The graphical score of the ANS. TCA.

fig 7.53 The coder of the first version of the ANS. Journal *Znanie sila*, N.3, Moscow, 1960, p.29. AS library.

to penetrate the reading device and be transformed into a sound. A similar principle of the graphical score was used in the legendary UPIC computer system, developed by Iannis Xenakis in 1977 in the Parisian CEMAMu (Centre d'Etudes de Mathematiques et Automatiques Musicales). The non-drying mastic allows for immediate correction of the resulting sounds: portions of the plate that generate superfluous sounds can be smeared over, and missing sounds can be added. The speed of the score can also be smoothly regulated, all the way to a complete stop. All this makes it possible for the composer to work directly and materially with the production of sound.

Twenty bandpass amplifiers are on the left side of the main front panel of the ANS. In the centre of the synthesizer is the reading device and the pitch scale and coder.■ The black board on the right side is the operating field, or the score. On the lower front panel are keys for controlling the twenty bandpass amplifiers and a joystick for controlling the tempo. The performance tempo depends upon the score-reading rate and can be varied without changing the pitch and timbre of the sounds. The graph of the coded melody looks similar to its notation in music in that the horizontal axis represents time while the vertical denotes pitch.

figs 7.53, 7.55

fig 7.54 The group of composers working with the ANS: standing, from left: Eduard Artemyev, Alfred Shnitke, Alexander Nemtin, Edison Denisov; sitting, from left: Oleg Buloshkin, Sofia Gubajdulina and Stanislav Krejchi. Moscow, 1968. Courtesy of Julia Murzina.

In 1967 in Moscow, with the ANS Synthesizer at its core, the studio of electronic music was established. Among the composers working with the ANS were Alfred Shnitke, Sofia Gubajdulina, Edison Denisov, Eduard Artemyev, Alexander Nemtin and Stanislav Krejchi.

The instrument was used for scoring many films, in particular, the early films of Andrey Tarkovsky. However in spite of the obvious success of the project, Boris Yankovsky was never involved in its further development.

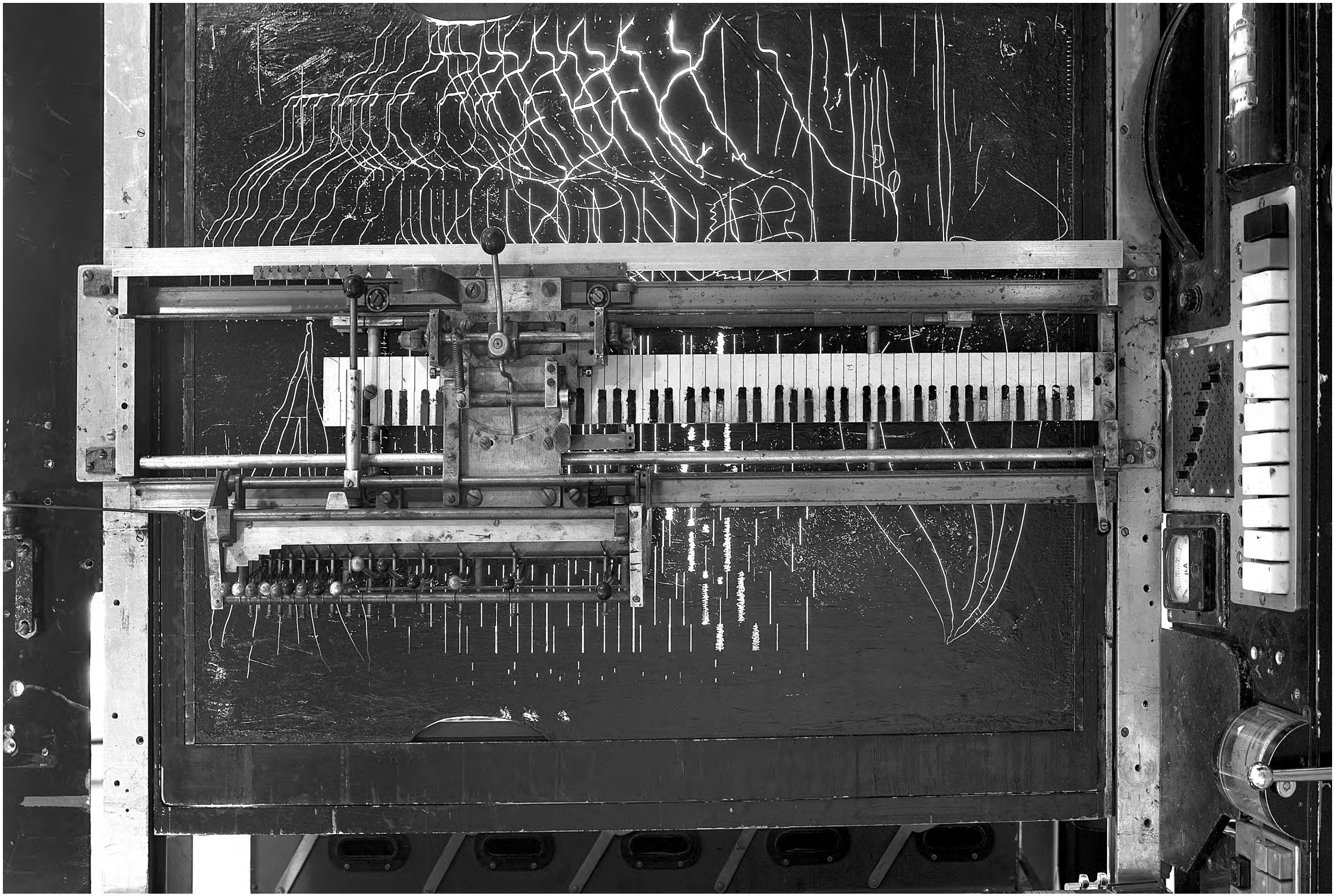


fig 7.55 The score with the coder of the ANS. TCA.

fig 7.56 Evgeny Murzin. c. 1960. Journal *Znanie sila*, N.3, Moscow, 1960, p.27. AS library.

EVGENY MURZIN (1914-70) was an inventor who completed his studies in 1938 at the Moscow Institute of Engineers of Municipal Construction, and by 1941 had finished postgraduate studies at the same institute. During WWII he attended courses at the Dzerzhinsky Military Academy in Moscow.

During the war he worked as a military technician and inventor in military research laboratories. Later, as a military inventor and senior lieutenant, Murzin was directed to a secret scientific research institute. There he directed the development and tested the fighting conditions of various control devices for ground artillery. In 1945, after the war, Murzin finished his master's thesis on these subjects. Later he was involved in the development of equipment for audio investigations for ground artillery, and instruments and methods for engaging fighter-interceptors with enemy bombers. In 1945-50 Murzin was the assistant of the lead technician in his laboratory. From 1951-53 he was largely responsible for the production of equipment for the fighter corps of the air defence of the USSR.

In 1938 Murzin proposed the project of the ANS sound synthesizer which was finally built in 1958. In 1967 Murzin was appointed head of the first Soviet Electronic Music Studio at the Scriabin Museum in Moscow.

BACK TO SYNAESTHESIA

In December 1958 in Moscow, Evgeny Murzin applied for a patent entitled 'Visual Prosthesis for General Use by the Totally Blind',[52] concerning an apparatus which mapped 'viewed' images across into sound, thereby producing a kind of artificial synaesthesia. In general the proposed system was based on the same principles as the ANS Synthesizer.

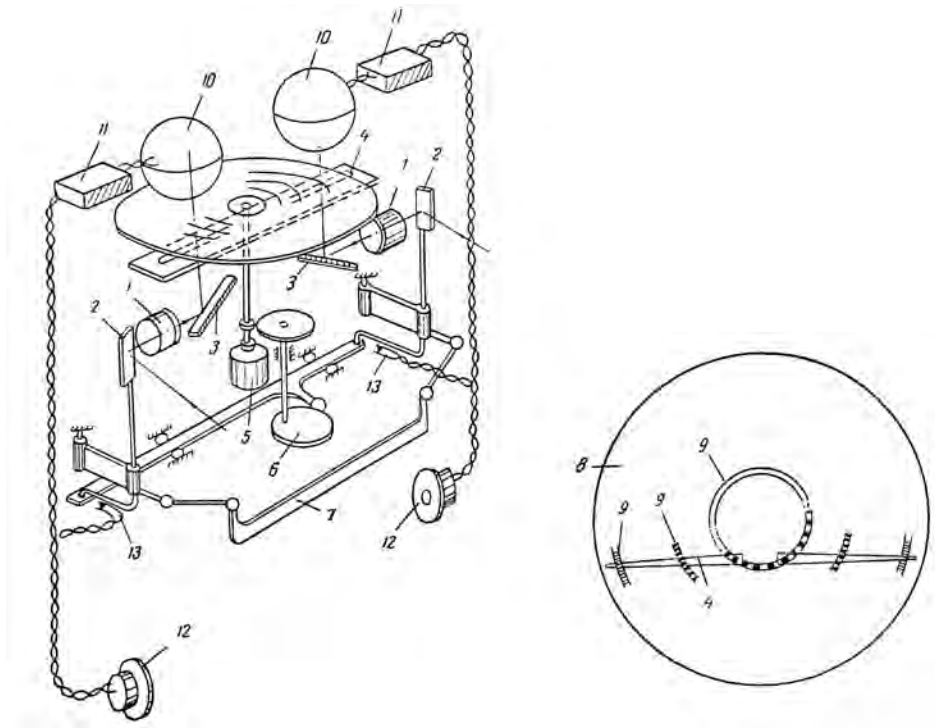


fig 7.57 Visual Prosthesis. Diagram from the Copyright Certificate. TCA.

This visual prosthesis system was conceived as an optoelectronic camera mounted on the head of the user.It contained two lenses (1), and two scanning mirrors (2), which are directed forward in eye-like fashion. These mirrors periodically scan the user's notional field of view, sending an image through each lens to a motionless mirror (3), and then on through an aperture (4), which passes only a thin vertical slice of the 'visible' projected image. The scanning of the mirrors is carried out mechanically by means of an eccentrically mounted wheel (6), rotated by an electric motor (5). The images in both halves of the aperture (4) only coincide at a given moment for those objects that are located at equal distances, coordinated according to the parallactic angle of the mirrors. Differences between the left and right images reaching each half of the aperture due to the spacing of the mirrors, produces, in effect, a stereoscopic image. In order to define

52 Murzin, E. 'Zritelny protez obshego polzovania dlia sovershenno slepih'. Copyright Certificate No. 151 060, USSR, applied for 30.12.1958. Supplementary Copyright Certificate No. 151 059, applied 30.12.1958, USSR 'Sposob preobrazovania v zritelnom proteze obshego polzovania opticheskogo izobrazhenia v zvukovie signali' (Visual Prosthesis for General Use by the Totally Blind).

the distance to a particular object, the user can change the parallactic angle of the system by changing the relative angle of coordination of the scanning mirrors (2). This is achieved by moving a bar (7) upwards or downwards, using the muscles of the forehead.

To distinguish between different elements of the image along the scanning aperture, the light is modulated with a frequency, which changes along the aperture's length. This is achieved by means of a rotating transparent optical disk-modulator (8), located above the aperture (4). The disk has discrete concentric optical soundtracks consisting of sinusoidal tones (9) photographed onto it, with the frequency of each track increasing from the disk's centre to its periphery. The modulated light, when detected by photovoltaic cells (10), produces a corresponding current, which is then amplified (11) through headphones (12), to produce sounds with different pitches and complexities, the height of the image corresponding to pitch, and the brightness to amplitude. To indicate the beginning of each scanning period, the outputs of the amplifiers are short-circuited by contacts (13), when the mirrors reach their limiting position. Each photocell is therefore capturing light, modulated by all the optical soundtracks at once, with varying intensities related to the brightness of the corresponding parts of the image.

Murzin anticipated that large bright parts of the image would produce intensive noise, masking other details of the picture. To avoid this phenomenon the width of the aperture (4) varies from the disk's centre to its edge, changing by an amount equal to the wavelength of the corresponding sinusoidal tones at any given point. Such variation allows for extreme contrasts in the image, since any area of complete black or white covering the aperture (4), will produce no modulation of the light and, consequently, no sound in the headphones. Modulation and a corresponding sound will occur only when a boundary produced by a change in contrast of the image passes through the aperture. Consequently, one will hear sounds corresponding to the boundaries forming the images, and not continuous, undifferentiated areas. In slightly offsetting the correspondence between the width of the aperture (4) and the wavelengths of the modulating sinusoids in each related soundtrack, a weak noise related to continuous light spots is produced to define light exposure inside contours, to determine large objects and undifferentiated visible areas. Thus, by means of two parallel scanning systems having slightly different points of view, it is possible to resolve the contours, or outlines of objects by their position in relation to the mechanism, and therefore the user's head. Murzin proposed that with practice, a blind user might learn to decode the complex sounds produced by this apparatus as a meaningful representation of vision.

Despite its happy destiny, the ANS Synthesizer and its derivatives were the last original and significant developments in the realm of music technology to be made in the USSR.

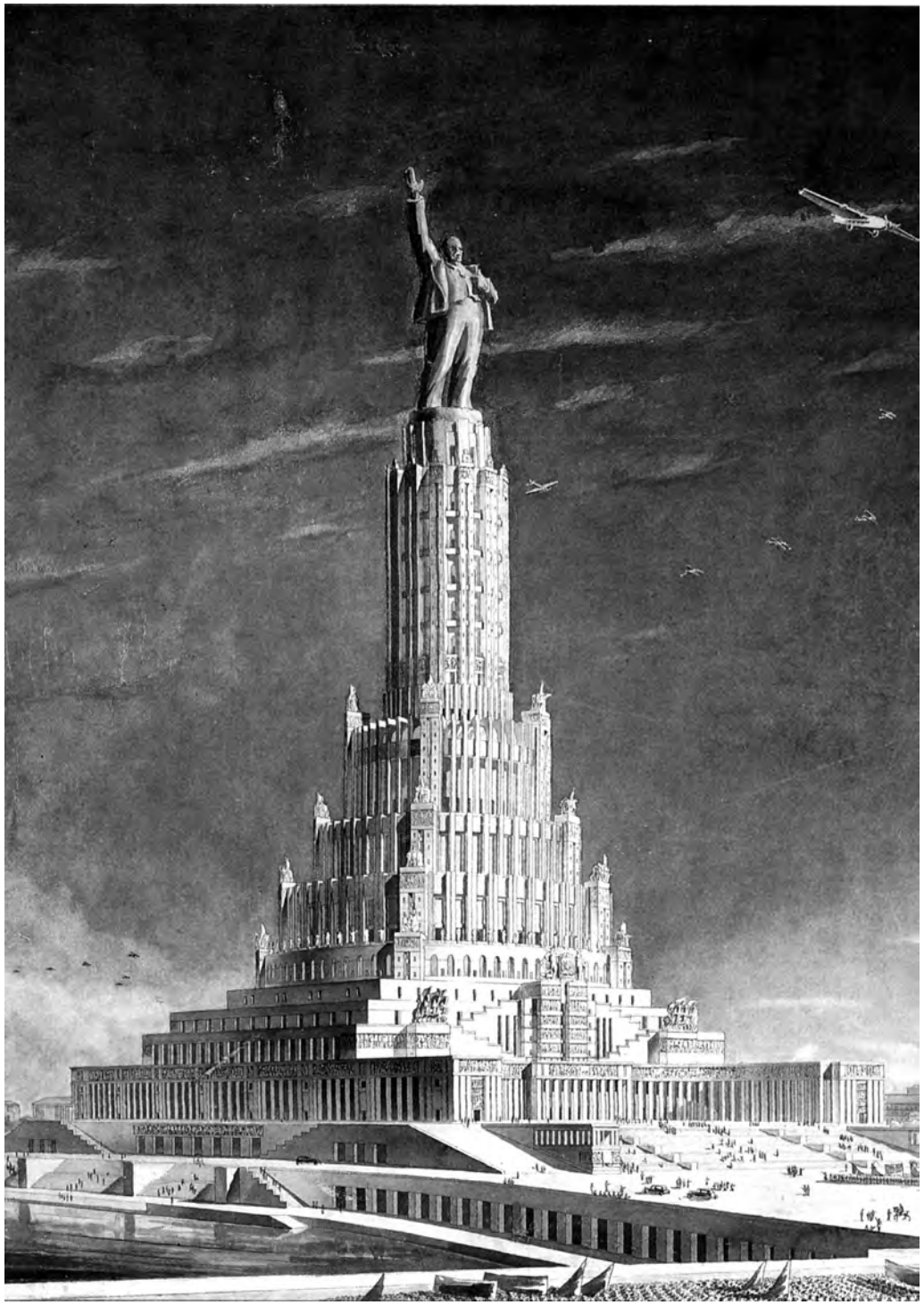


fig 8.1 The Palace of the Soviets. Unrealized project of the 'proletarian miracle' which was intended to be the largest building in the world. The height of the construction was to be 420 metres and the volume 7.5 million cubic metres, exceeding the volume of the pyramid of Cheops three times. Moscow, 1930s. Iofan, B., Gelreich, O., Shuko, O. *Visotnie zdania v Moskve*, Moscow, 1950.

8. THE DESTRUCTION OF UTOPIA

THE STATE VS. SOCIETY

Every revolution evaporates and leaves behind only the slime of a new bureaucracy.

Franz Kafka

Bureaucratic authoritarian states, regardless of their ideologies, have a similar, pyramidal structure: a single figure of the 'National Leader' standing above any law at the top, society at the bottom and numerous levels of bureaucracy in between. The basic functioning of these systems, often referred to in Russia as 'the vertical of authority' (the chain of command), is unchanging, conspiring by means of any ideology or religion that serves it to create a monopoly for authority and to limit vertical mobility. Often, the only effective mechanism of vertical displacement is corruption.

In Russia in the 1920s and 30s, to get support or simply a permission to develop a project one had to apply to the local authority which in turn, to avoid responsibility, would apply to the next bureaucratic level and so on. As the higher echelons used to be almost unreachable, proposals would normally get stuck within the bureaucratic mill, circulating between different levels and offices.

By their very nature, authoritarian states are not interested in supporting ideas that provoke society into activity that might undermine their authority. Any 'modernization' of a system inevitably turns out to be damaging, isolating and degrading, resulting in demagogy, fear, apathy and ignorance at best and intimidation, imprisonment or physical termination at worst. Intellectuals who could be forced into loyalty were built into the machine, functioning as components and agents of the system. 'Upstarts', radicals and 'loose cannons' were targeted by intelligence services or criminals and treated with such repressive measures that they would often lose their jobs, be thrown into prison or put to death.

Without effective local self-management, authoritarianism thrived, suppressing the horizontal social and professional creative networks that had emerged despite the oppressive context.

UTOPIA VS. ANTI-UTOPIA

The State has a cudgel in its hands that hits just once, but on the head.
Vladimir Putin, 2000[1]

After the October Revolution the relationship between State and pioneers became a complicated one. When at the end of 1917 Lunacharsky invited 150 of the most outstanding representatives of Petrograd's intelligentsia, only five showed up.[2] Nevertheless, although many people didn't accept the October Revolution and chose to leave the country by any means available to them, numerous creative, artistic people were misled by the revolutionary ideas, believing that the social revolution would inevitably lead to full cultural renovation, through which the most futuristic of ideas would be achieved.

The mentality of a variety of artists — Kazimir Malevich, Vladimir Tatlin, Wassily Kandinsky, Alexander Rodchenko, Olga Rozanova, Varvara Stepanova, Nadezhda Udaltsova and many others — was formed under the strong influence of different kinds of anarchism. Many of them 'rendered strong support for the theory and practice of (post-)revolutionary anarchism by their manifestos and statements from September 1917 until July 1918, which were published in the newspaper of the Moscow federation of anarchist groups, *Anarchy*.'[3]

In 1919 the painter Varvara Stepanova noted in her diary: 'The principles of Russian painting are as anarchical as Russia with its spiritual movement. We have no schools, each painter is a creator, everyone, whether an innovator, synthetic or realist, is original and highly individual.'[4] This might be viewed as a metonym for the whole of the Russian revolutionary artistic Utopia of the early 1920s, when the Russian State was almost at the point of collapse and society was structured as a kind of anarchical 'network culture', based on numerous cross-connected 'creative units' comprising artists, scholars and politicians. Artist and philosopher Solomon Nikritin called on people to concentrate 'all the intellectual work of the masses... in one discipline — in the projectionist expression of organizational classification and methodology — [which] is the realization of [the art of] Projectionism... — the algebra of organizational science.'[5] In his own, odd-sounding way, what he was striving for was the evolution of consciousness of the masses to create a future classless society which would be based on a creative human network without any central authority — an idea that he had in common with one of the most influential Russian anarchists of the time, Prince Pyotr Kropotkin. Alexei Gastev proclaimed in 1920: 'We should overcome the stagnancy of the people, straighten them, infect them with the demon of work, to create from the USSR the devil of energy for the world. Then we shall win. In this way, we will transform the entire world.'[6]

This curious vision of an artistic Utopia coexisted with the brutal policy of War Communism, conducted by the state during the Civil War and which was replaced by the New Economic Policy in 1921, when socialist approaches were combined with possibilities of free enterprise.

Lenin's death in 1924 resulted in a political sea change. According to one commentator of the time, the alternative way to the ideal future society seemed clear: 'The proletarian compulsion in all forms, starting with executions and finishing with a duty to labour, is a method of developing communistic mankind...'[7] The consolidation of Stalin's dictatorship gradually triggered a period of control, antagonism and repression among the most outstanding, skilled and innovative representatives of Russian society, destroying the new emerging culture. Solomon Nikritin wrote to Nikolai Bukharin in 1930: 'We are already really starting to lose all of our prospects, we have nothing with which to carry on along our main path of new culture, and all our work, all our activities are starting to turn into the purely provincial, of a local character.'[8]

The Stalin era was characterised by bureaucratic control and the reign of Socialist Realism in all fields of the arts including music. The ideological doctrine of 'Socialist Realism' was proclaimed in 1934. It was explained as a 'truthful and historically concrete depiction of reality in its revolutionary development'.[9] In musical terms, this demanded the composing of patriotic, elevating scores, preferably with topical or folkloric content, that were supportive of the Communist ideology and the regime, as well as simple and accessible for the 'masses'. All experimentation or deviation from these ideals was branded as 'formalism', and condemned together with the 'decadent music of the rotten West'. This policy resulted in the State campaign against experimental music and art as well as many areas of experimentation and advancement in science and culture throughout the 1930s.

The early 1930s was a critical moment that witnessed the clash between two powerful cultures — the artistic and scientific Utopia of the 1910s and 20s and the totalitarian, highly centralized anti-Utopia of the 1930s through to the 50s. During the ensuing Great Terror, which included the notorious show trials of Stalin's former Bolshevik opponents in 1936-38 and reached its peak in 1937 and 1938, millions of innocent Soviet citizens were sent to labour camps or killed in prison. By the time the terror subsided in 1939, Stalin had managed to bring both the party and the public to a state of complete submission to his rule. Soviet society was so dispersed and the people so fearful of reprisals that mass arrests were no longer necessary. Stalin ruled as absolute dictator of the Soviet Union throughout World War II and until his death in March 1953.[10]

1 Putin, V. From an interview with *Le Figaro* newspaper, 26 October 2000.

2 *Istoria russkoi sovetskoi muziki* (The History of Russian Soviet Music). The plan-prospectus. Ed. U.V. Keldish, S.S. Skrebkov, I.J. Rizhkin. Leningrad, Academy of Sciences of the USSR, 1950, s. 3.

3 Burenina, O. *Anarchy and power in art*. Zurich, http://lit-red.ru/all/?dl_id=3. Trans. AS.

4 Stepanova, V. *Chelovek ne mozhet zhit bez chuda* (The Human Can't Live without a Miracle). Moscow, Sfera, 1994, s. 73. Trans. AS.

5 Nikritin, S. 'Osnovnoe' (The basics). Draft manuscript, 1924. RGALI, f.2717. op. 1, e.h. 17, s. 24. Trans. AS.

6 Gastev, A. *Yunost idi!* (Youth go!), Moscow, VSSPS, 1923, p. 34. Trans. AS.

7 Bukharin, N. *Ekonomika perehodnogo perioda* (Transitional Economy), chapter X, Otd. izd., Moscow, 1920, s. 146. Trans. AS.

8 Nikritin, S. From the letter to Nikolai Bukharin, Moscow, 1930. Trans. AS.

9 The charter of the Union of writers of the USSR, 1934. Istoria Rossii. 1917-1940. The reading book. Compiler V.A. Mazur. Ed. M.E. Glavatsky. Ekaterinburg, 1993.

10 Revelations from the Russian Archives, 'Repressions and terror: Stalin in control', Library of Congress. http://www.loc.gov/exhibits/archives/reps.html

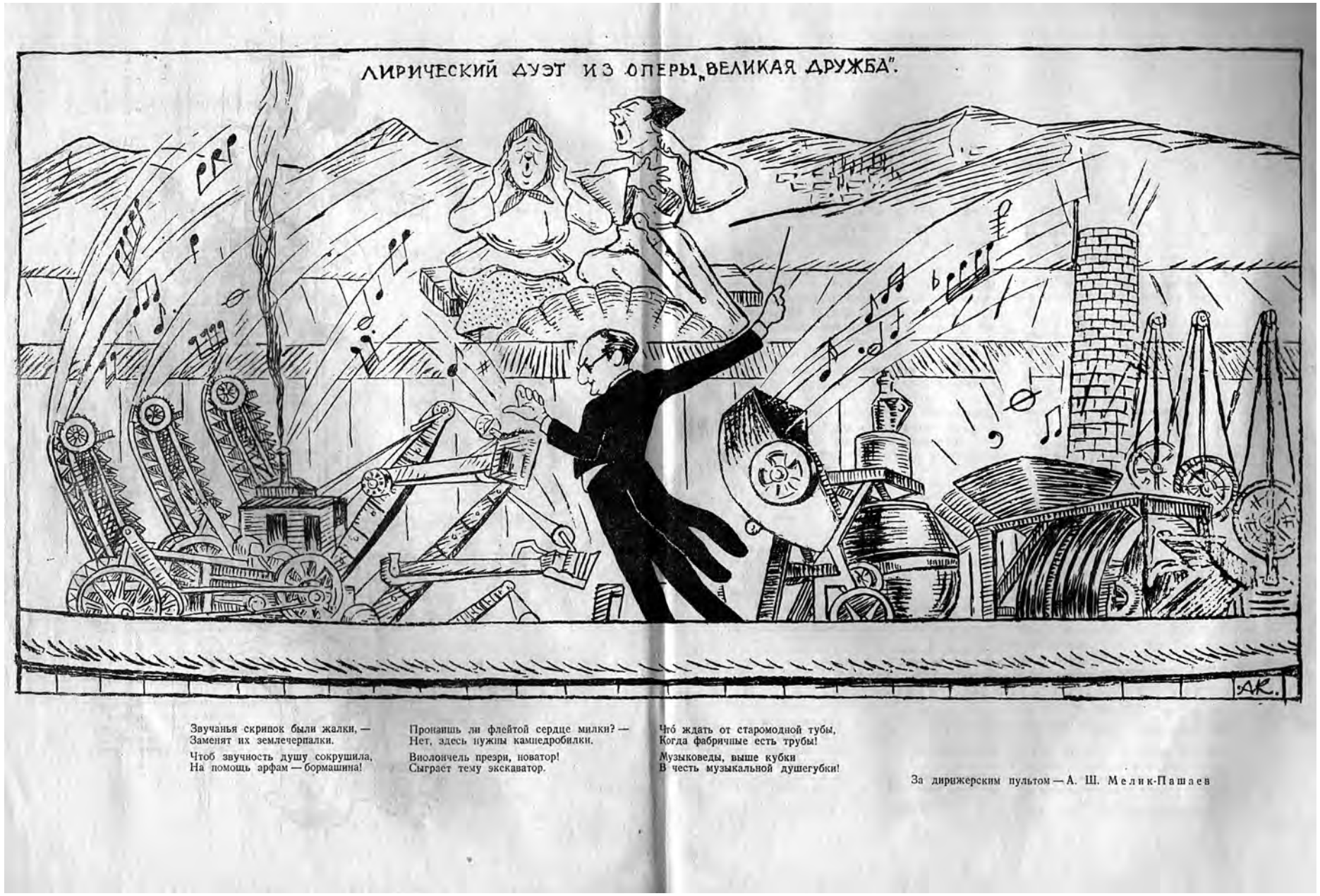


fig 8.2 The lyrical duet from the opera *The Great Friendship*. *Sovetskaya muzika* magazine, N.1, 1948, pp.109-110. Translated by A. Smirnov. AS library.

A violin has no choice –
It is replaced by dredger's voice.

To break a soul with sonority
A drill extends the harp's authority.

No flute will pierce the darling's heart
without stone-crusher's stab.

Despise the cello, innovator!
The theme be played by excavator.

What to expect from old tubas,
When plants and factories have hooters?

Hey musicologists, lift up your cups,
For the musical mass-murder-bus!

In 1932 the Union of Composers of the USSR (as well as other creative unions of artists, architects, writers, and so on) was organised according to the Communist Party Resolution 'On the Reconstruction of Literary and Artistic Organisations', issued on 23 April 1932. This was followed by the liquidation of two previously existing composers' organisations: the Western and modernist oriented ACM (Association for Contemporary Music), and RAPM (Russian Association of Proletarian Musicians), which proclaimed that mass song should be the basis of Soviet music. In 1939 the government instituted an Organizational Committee (Orgcomitet) of the Union of Composers.

On 11 February 1948 the newspaper *Pravda* published the Resolution of the Political Bureau of the Central Committee of the Communist Party about the opera *The Great Friendship* by composer Vano Muradeli. In it, they condemned him for 'musical formalism' and his opera was declared anti-artistic. As a result of this resolution the pressure on the composers Dmitry Shostakovich, Sergei Prokofiev, Nikolai Myaskovsky, Vissarion Shebalin, Aram Khachaturian and others reached its peak. It was soon followed by the infamous *auto-da-fé* of the meeting of the musical workers at the Central Committee under the chairmanship of a member of the Political bureau, Andrey Zhdanov. At this meeting, Zhdanov compared music by Prokofiev and Khachaturian with the sound of a dentist's drill and a 'musical murder bus'.

A meeting of the First Congress of the Composers' Union which took place on 19-25 April 1948 added another nail to the coffin of composers with avant-garde ambitions. At the congress, the Organizational Committee of the Composers' Union was replaced by communist party functionaries, and Tikhon Khrennikov was chosen by Zhdanov and Stalin for the post of general secretary. He held this position for forty-three years until the collapse of the Soviet Union in 1991. The historical circle closed up: it is quite symbolical that the official news-reels 'Novosti dnia N23' (Daily news) regarding the Congress were produced in April 1948 by Dziga Vertov. It was the final blow for the musical avant-garde in Soviet Russia. Similar scenarios followed in the arts and sciences including an infamous battle against cybernetics, which was branded 'a "science" of obscurantists'[11], while genetics was accused of being nothing more than 'a selling maid of imperialism'.[12] The last phase of Stalin's epoch brought an end to much institutionally supported experimentation in music and audio technology as well as the most innovative emerging culture and sciences, except a few areas which happened to fit within the official ideological boundaries or were considered to be of strategic use. 'It is an "accursed desert"', to use Saltikov Shedrin's words. Everything of talent, contrary to the circumstances, that was created during this period, was consigned to history.'[13]

11 Yaroshevsky, M. *Literaturnaya gazeta* (The Literary Newspaper), 5 April 1952.

12 This phrase is often attributed to academic Trofim Lysenko. In fact the authorship belongs to writer-satirist Alexander Hazin.

13 Glazichev, V.L. 'Russia in a loop of modernization: 1850-1950'. http://glazychev.ru/books/petlya/petlya_13_1949.htm. Trans. AS.

fig 8.3 The chairman of the Committee on Arts Affairs at SNK USSR, Platon Kerzhentsev (first on the left) talks to representatives of amateur artistic collectives during the 1st Decade of National Art, Moscow, June 1936. Photo by J.N. Halip. RGAKFD, ed. hr. 368858.

BUILT INTO THE MACHINE

'If the party... demands that the colour white is considered as black I shall accept it and make it my belief.'[14]

Georgy Piatakov. 1928.

Among the most characteristic and influential cultural functionaries of the 1930s was Platon Kerzhentsev (pseudonym of Lebedev) (1881-1940) — a Soviet statesman, well-known antagonist of Alexei Gastev, and the theorist and organizer of scientific management of the Soviet State. His approach was very much based on the principle of vertical authority. Kerzhentsev studied in the department of history and philology of Moscow University. He was influenced by Percy MacKaye, Richard Wagner and Alexander Bogdanov. As a result of his revolutionary activism, Kerzhentsev was subjected to repression. In 1910-13 he lived as an immigrant in London, New York and Paris.

The author of a number of works on history, he was a contributor to and assistant editor of the newspaper *Izvestia* from 1918, executive director of the Russian Telegraph Agency (ROSTA) in 1919-20, in plenipotentiary in Sweden from 1921-23, member of the editorial board of *Pravda* in 1923-24, and in plenipotentiary in Italy from 1925-26. In 1926-27 Kerzhentsev was Chairman of the editorial board of OGIZ (Association of State publishing houses) and one of the founders of the system of Soviet censorship.

In 1936-38 he was the Chairman of the watchdog All-Union Committee on Arts Affairs. He is purportedly the author of the infamous anonymous article 'Confusion instead of music' published in 1936 in the newspaper *Pravda*. With this article he began to purge the Bolshoy Theatre

14 Valentinova, N.V. 'Razgovor s Piatokovim v Parizhe' (A Conversation with Piatakov in Paris) (1958) in the collection *Stranitsi istorii* (The Pages of History). 1989 Lenizdat, 1990, p. 85. Trans. AS.

administration as a part of the ideological campaign against 'anti-democratic', 'formalist' experimentation in Soviet art. The same year he directed to Stalin a report in which he suggested removing works by Russian avant-garde artists from the open exhibition of the State Tretyakov Gallery and Russian Museum.

On 7 February 1936, after the publication of the aforementioned article in Pravda, Kerzhentsev wrote a top secret letter to Stalin and Molotov:

Today I was paid a visit (on his own initiative) by the composer Shostakovich. In answer to my question as to what conclusions he had drawn for himself from the article in Pravda *he replied that he wished to demonstrate through his creative work that he has accepted the directives in the editorial.*

When I asked if he fully agreed with the criticism of his work, he said that he did agree with most of it, but had not yet fully grasped all of it...

I instructed him to free himself from the influence of certain docile critics like Sollertinsky, who encourage the worst aspects of his work stemming from the influence of western Expressionists...

I advised him to follow the example of Rimsky-Korsakov and travel through villages of the Soviet Union and write down folk-songs from Russia, the Ukraine, Belorussia and Georgia and select and arrange the Hundred Best among them. This suggestion appealed to him and he said that he would do this.

I proposed that next time he starts composing an opera or a ballet he should send us the libretto and that, while engaged in such work, he should try out some completed pieces in front of an audience of workers and collective-farmers. He asked me to let you know that Soviet composers would very much like to meet with Comrade Stalin for a discussion.[15]

Although Platon Kerzhentsev was responsible for the 'successful' persecution of Vsevolod Meyerhold, Mikhail Bulgakov, Dmitry Shostakovich, Sergei Prokofiev and many others, in January 1938 in his report at the plenum of the Central Committee of Communist party, Andrey Zhdanov declared: 'During the past two years Kerzhentsev and his assistants have not completed the required tasks.'[16]

In 1938 he was removed from his position. In 1939-40 until his death he was the deputy editor-in-chief of the Big and Small Soviet encyclopedias, which introduced the new officially censored version of the history of Russia, rewritten according to the political order of Stalin's authorities.

15 Memorandum written by Platon Kerzhentsev — the Chairman of the Committee for the Arts affiliated to the Council of People's Commissars of the USSR. 7 February 1936. Published at http://live.shostakovich.ru/chronicle/year-1936/. Trans. AS.

16 Zhdanov. Speech at the plenum of the Central Committee of the Communist party, January 1938.

fig 8.4 Evgeny Sholpo. Leningrad, 1944. Courtesy of Marina Sholpo.

ONE MONTH IN THE LIFE OF EVGENY SHOLPO

To get funding for his laboratory Evgeny Sholpo had to present music created by means of the Variophone to NIMI experts and professors from the Moscow State Conservatory. For this purpose on 10 June 1937 he arrived in Moscow. His plan was:

1 To arrange a hall

2 To check his equipment

3 To invite experts

4 To make a presentation

5 To have an official review signed with all the required signatures.

To achieve this he spent an entire month, during which he was compelled to spend many hours daily travelling between offices and queues. Although he finally managed to get everything done and his presentation received a very positive review, he didn't get any funding because the secretary of the Committee on Arts Affairs forgot to include the Laboratory for Graphical Sound (affiliated with the Musical Institute) in their final list. The whole process was carefully documented by Sholpo in his diary.

Evgeny Sholpo's diary

10 June – 3 July 1937

On the 10th June, 1937, in the morning at the Leningrad railway station in Moscow we agreed to meet next day at 12pm with the director of the Leningrad Scientific Research Institute R. Bauze to visit together the Chief of the Department of Musical Organizations S. Shilov. On the 11th June in the afternoon I waited for Bauze at the Department of Musical Organizations. He didn't come. At the same place on the 13th June from 11am I was again waiting for Bauze with the same result. The same happened on the 14th June.

On the 16th June I made a phone call to the Department of Science and Inventions TsK VKP(b)[17] *to comrade Shilov and asked him for an appointment. 'Come tomorrow.' On the 17th June at 11 am I was received by Shilov. We had a conversation. He became acquainted with my business. He promised to report to Bauman and to make a phone call to Platon Kerzhentsev.*

On the 20th June at the Department of Musical Organizations I was received by Shatilov. I told him that I had come to introduce Kerzhentsev to my work. At my presence Shatilov made a phone call to Kerzhentsev's assistant comrade Vientraub and suggested that I make a presentation of my works to Kerzhentsev. He didn't get any certain reply and suggested I call him later to inquire about the answer. I called Shatilov. He was absent. The secretary recommended I call Vientraub. I call Vientraub – he knows nothing and suggests I call Shatilov. I call Shatilov and get the reply that Kerzhentsev has scheduled a presentation for tomorrow at 11am. I call Vientraub and learn that the sound-film equipment in the House of the Soviet People's Deputies (SNK) is broken and I have to get in contact with the assistant manager of the Administrative Department, comrade Chernov. In the evening I call Chernov – he is absent. I call Vientraub – he is also absent. On the 21st June from 10am until 1pm I was at the House of SNK meeting with the manager of the Administrative Department, Chirkov, searching for technicians (by phone) to repair the equipment. No success. I was sent to the Vostokkino cinema to check their equipment. The equipment was in use. I had to come at 7:30pm. Around 8pm at Vostokkino I checked my repertoire. The equipment was bad.

On the 22nd June in the morning I went to the House of SNK to tell Vientraub that the equipment at Vostokkino is unsuitable and that it is necessary to look for another place for the presentation. 'That is Shatilov's business.' I go to Shatilov. There is a queue at reception. I was directed to Shatilov's assistant – comrade Shapiro. He was trying to call Vientraub without success: 'He will come after 5pm.' He writes down my phone number and promises to call back tonight or tomorrow in the morning. (He never called at all.)

On the 23rd June in the morning I go to the Department of Musical Organizations to meet comrade Shapiro. He calls the manager of the Administrative Department comrade Chernov and finds out that the equipment has been fixed. I go to Vostokkino to take from there a small suitcase with a film and bring it to the House of SNK. They receive a call from the technician and, finally, I am able to hear my material. It sounded very good, and I left a film in the studio. I went to Chernov and made a phone call to Shatilov. He sent me again to Vientraub. In my presence Vientraub called Shatilov. A problem: how to invite the committee for the presentation if the date and time are unknown and depend on the decision of Kerzhentsev?

On the 26th June in the morning I call the Committee on Arts Affairs. The secretary of Kerzhentsev answers and says that I should talk about the presentation with Shatilov. The secretary of Shatilov tells me that he is at the vocal commission and I have to call later. At the end of the day at the Department of Musical Organizations Shapiro told me that Shatilov won't make any appointments with Kerzhentsev. Let Kerzhentsev define the day and time himself and Shatilov will be informed. There was nobody at the House of SNK. On the 26th June I spend the morning calling Vientraub. He asks me to wait by a phone, then he asks me to call back at 1pm. I have been calling continuously from 1pm until 5pm to no avail. Finally I get a reply from Vientraub: 'Tomorrow at 11am Shatilov will go to Kerzhentsev to discuss the time of the presentation.'

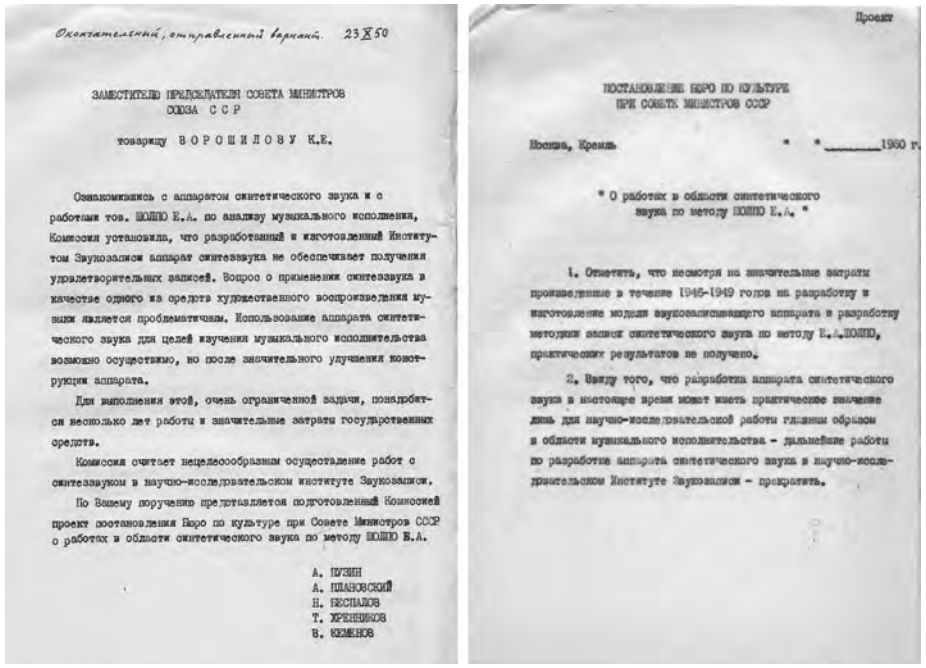
On the 27th June in the morning I met Shatilov at the House of SNK. He told me that Kerzhentsev can't come to the presentation, we have to make it without him tomorrow at 2pm.

The commission gathers on the 28th June at 2pm at the House of SNK. Everybody is waiting on the stairs since the hall is locked and the keys have been taken by a technician. Eventually the hall is opened by the charwoman. We wait for a technician. The members of the commission: Shatilov, his assistant comrade Gisin, professor Riazanov, professor Goldenweiser, professor Gedike and professor Garbuzov. I am asked to begin the report without waiting for the technician. I make a good, detailed report which, unfortunately, is not shorthanded since the stenographer, who was booked the day before, arrives only at the very end of presentation. Thus we allowed her to leave. After the report I gave a presentation of ton-films: 1) The Walz *by N. Timofeev, 2)* The Flight of Valkyries *by R. Wagner, 3)* 6th Rhapsody *by F. Liszt and 4)* The Song of Robert *by I. Dunaevsky. It was decided to issue the committee's impressions in the form of a resolution.*

On the 29th June in the morning at the Committee on Arts Affairs Riazanov prepares 'the conclusion of the commission'. I carry it to the Conservatory for Garbuzov's signature. He makes an essential addition after which I give the 'conclusion' to the Conservatory's office to reprint it again. On the 2nd July at the Conservatory I received the reprinted 'Conclusion of the Commission' and went to collect the signatures of Gedike, Garbuzov and Riazanov. When the papers reached Shatilov, he left all the copies in his office promising 'to send them later to Leningrad'. Outraged, I asked Riazanov to take copies from Shatilov but provision had not been for me to be able to retain even one copy (?!). Naturally, I did not obey. Having received the signatures of Gisin (as a chairman instead of Shatilov) and Goldenweiser, I gave myself the right to dispose of all the copies of this document at my own discretion.

17 *TsK VKP(b)* — Russian abbreviation of the Central Committee of the Communist Party of Bolsheviks.

On the 3rd July – the last visit to Shatilov. I asked: 'Is there any sense in me waiting here?' – 'No, certainly not. Please leave, otherwise you will become exhausted here...' I discovered that there is no money at all, as at the submission of the budgets for confirmation by the Soviet People's Deputies for 1937 the Musical Institute was forgotten and missed out...[18]



Окончательный, отправленный вариант. 23 X 50

ЗАМЕСТИТЕЛЮ ПРЕДСЕДАТЕЛЯ СОВЕТА МИНИСТРОВ
СОЮЗА ССР

товарищу ВОРОШИЛОВУ К.Е.

Ознакомившись с аппаратом синтетического звука и с работами тов. ШОЛПО Е.А. по анализу музыкального исполнения, Комиссия установила, что разработанный и изготовленный Институтом Звукозаписи аппарат синтезвука не обеспечивает получения удовлетворительных записей. Вопрос о применении синтезвука в качестве одного из средств художественного воспроизведения музыки является проблематичным. Использование аппарата синтетического звука для целей изучения музыкального исполнительства возможно осуществимо, но после значительного улучшения конструкции аппарата.

Для выполнения этой, очень ограниченной задачи, понадобится несколько лет работы и значительные затраты государственных средств.

Комиссия считает нецелесообразным осуществление работ с синтезвуком в научно-исследовательском институте Звукозаписи.

По Вашему поручению представляется подготовленный Комиссией проект постановления Бюро по культуре при Совете Министров СССР о работах в области синтетического звука по методу ШОЛПО Е.А.

А. ПУЗИН
А. ПЛАТОНОВСКИЙ
Н. БЕСПАЛОВ
Т. ХРЕНИКОВ
В. ЖЕМЧУГОВ

Проект

ПОСТАНОВЛЕНИЕ БЮРО ПО КУЛЬТУРЕ
ПРИ СОВЕТЕ МИНИСТРОВ СССР

Москва, Кремль * * _____1950 г.

" О работах в области синтетического
звука по методу ШОЛПО Е.А. "

1. Отметить, что несмотря на значительные затраты произведенные в течение 1946-1949 годов на разработку и изготовление модели звукозаписывающего аппарата и разработку методики записи синтетического звука по методу Е.А.ШОЛПО, практических результатов не получено.

2. Ввиду того, что разработка аппарата синтетического звука в настоящее время может иметь практическое значение лишь для научно-исследовательской работы главным образом в области музыкального исполнительства – дальнейшие работы по разработке аппарата синтетического звука в научно-исследовательском Институте Звукозаписи – прекратить.

fig 8.5 The official order for the disbandment of the Laboratory of Graphic Sound. Leningrad, 1948. Courtesy of Marina Sholpo.

THE STORY OF THE MAN AND THE TWENTY-THREE-STRING ELECTRIC GUITAR

In 1932, Communist Party organizer and amateur musician comrade Shtrianin, from the village Bessonovka (part of a farm collective called 'Giant') in the Bessonovsky area of the Kujbyshevsky region, decided to build a twenty-three-string electric guitar. To enhance its acoustical properties the body of the instrument was made from the deck of an old, discarded piano. To make pickups and electronics Shtrianin had to buy some parts. By 1935 his wife had already become unhappy with her husband's hobby because of the costs being incurred. Shtrianin asked his local communist chief, comrade Voskoboinikov, for financial support. He applied for 500 rubles — approximately the cost of a radio receiver at the time. According to Shtrianin's letter, his only intention was to finish the instrument and give a concert with it in his local village club.

figs 8.6-7 The Guitar built by Shtrianin. 1936. TCA.

18 Sholpo, E. Manuscript. Marina Sholpo Archive. Trans. AS.

But comrade Voskoboinikov felt unable to take responsibility for making such a decision, so he passed the request to the local House of Culture (named after Krupskaya — the spouse of Lenin). The staff there also couldn't take such responsibility and passed the request further up the chain.

The process took almost two years. Numerous institutions and bureaucrats of all levels became involved in the discussion. During the course of the discussion the subject of inquiry gradually changed. In official correspondence the discussion was already beyond the invention of comrade Shtrianin.

There was no final decision, although comrade Shtrianin never received the 500 rubles.[19] He finished the instrument at his own expense in late 1936 according to his final, angry, letter. Official correspondence about the application continued circulating until 1937. The last letter was sent by *Izvestia* newspaper with a request to 'review the twenty-four-string [sic] guitar invented by comrade Shtriakin [sic]'. It was erroneously addressed to the GIMN Institute, a fact which gave an opportunity to professor Garbuzov to reply that the GIMN Institute had closed in 1931 and that the NIMI Institute is unable to offer expert review. The correspondence stopped.

Correspondence 1935-37:

6.08.1935. The first detailed letter from comrade Shtrianin to his local communist chief Comrade Voskoboinikov with his proposal to build a twenty-three-string electrified guitar and with a request for support.

6.08.1935. The drawing and construction of the twenty-three-string electrified guitar. Appendix to the letter from 6.08.1935.

28.08.1935. The second letter from Shtrianin to Voskoboinikov with extra details regarding his twenty-three-string guitar. No inventions were proposed. The only intention of Shtrianin was to finish the instrument and to perform a concert in the village club.

15.09.1935. Official request for expert review of the 'invention' from the Central House of Amateur Culture addressed from N. Krupskaya to the NIMI Institute and professor Garbuzov.

3.10.1935. First review by E. Vitachek — the head of the Experimental Workshops of String Instruments at Moscow State Conservatory with a note that the instrument needs the expertise of guitar players. As of this point the subject of the discussion is shifted — all exchange is now about the new 'invention'.

22.12.1935. Official reply from N. Garbuzov to the Committee for Inventions in which he gives a negative conclusion regarding the proposed 'invention'.

19 In fact the story had a happy ending. Shortly before the publication of this book the twenty-three-string guitar was identified in the storage of the State Museum for Musical Culture (named after M. Glinka) in Moscow. It was donated to the museum by the Central House of Amateur Culture (previously named after N. Krupskaya), which purchased the instrument in the late 1930s for 508 rubles.

16.06.1936. Review and reply by E. Vitachek to N. Garbuzov.

10.04.1936. Official request to review Shtrianin's 'invention' by the central newspaper *Izvestia* to the NIMI Institute.

4.06.1936. Front and back view of the twenty-three-string guitar which by now had finally been built. Appendix to the letter.

4.06.1936. Last letter from Shtrianin to the NIMI Institute with his indignation and surprise at such 'un-communist behaviour' and notice that he had finished the instrument at his own expense and had started a new one.

3.10.1936. One more round of correspondence with Vitachek. Discussion of the commercial angle of the production of the instrument and note that for any conclusion they need the finished instrument for review by experts.

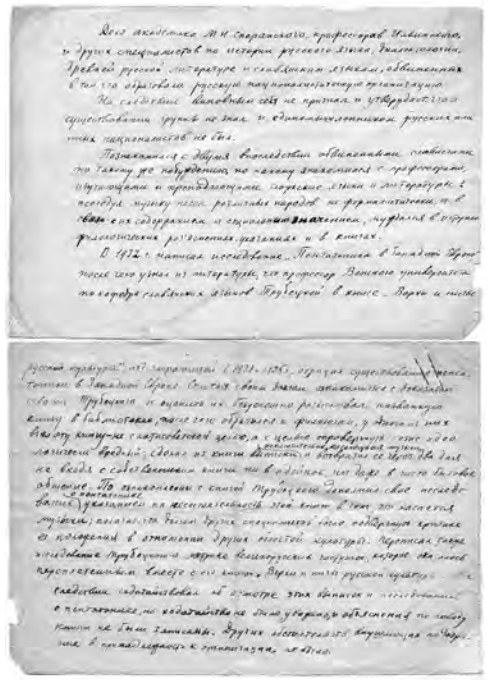
1936. Review of the twenty-three-string guitar by guitarist Veshitsky in which he reports that he can't give any conclusion unless Shtrianin finishes the instrument and sends it for expert testing.

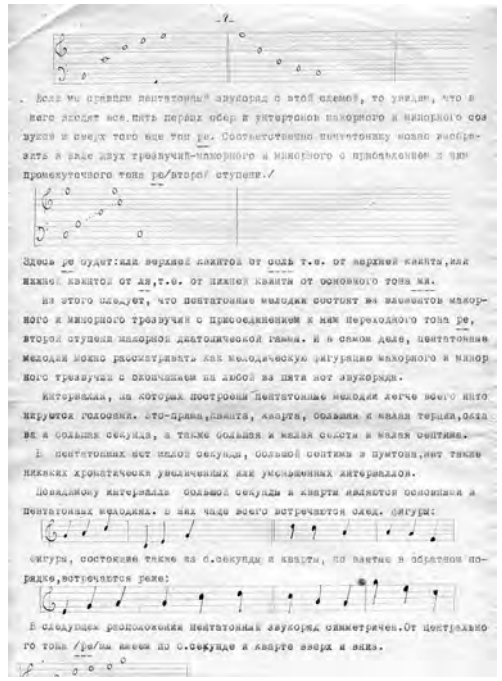
11.10.1936. A further request to GIMN [sic] by the newspaper *Izvestia* to review the 'invention' by Shtriakin [sic] — the twenty-four-string guitar [sic].

Early 1937. Last official reply from N. Garbuzov (NIMI) to the newspaper *Izvestia* with a note that the GIMN Institute was closed in 1931 and that the NIMI Institute is unable to offer expert review.

fig 8.8 Liubov Pchelkina and Andrey Smirnov with the twenty-three-string guitar at the State Museum for Musical Culture named after M. Glinka, Moscow, 7 November 2011.

fig 8.9 Correspondence 1935-37. TCA.





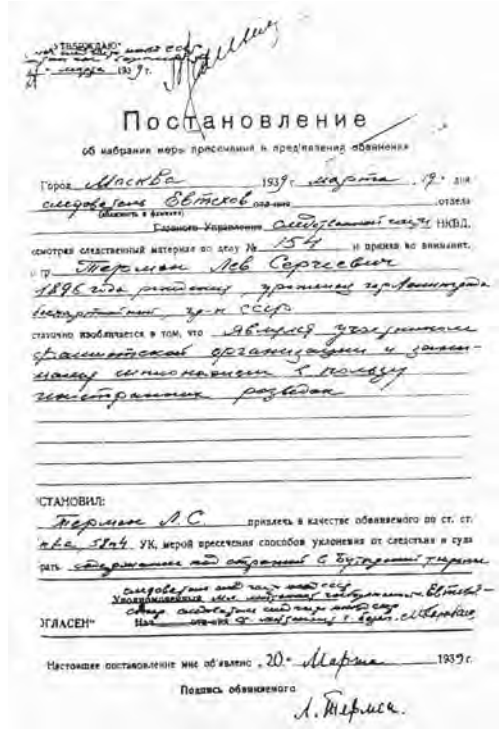


fig 8.10 The note from Kliment Kvitka in which he explains the story of his arrest and asks the Conservatoire's administration for assistance in removing a previous conviction. TCA.

fig 8.11 (top right) One page of the theoretical work that became the reason for the arrest of Kliment Kvitka. TCA.

fig 8.12 A copy of the official decision concerning the arrest of Leon Theremin. 1939. Courtesy of Sergei Zorin.

fig 8.13 (bottom right) A copy of the warrant for the arrest of Leon Theremin. 1939. Courtesy of Sergei Zorin.

THE PROFESSOR IMPRISONED FOR PENTATONIC RESEARCH

In 1932 Professor Kliment Kvitka at Moscow State Conservatory, one of the founders of Soviet musical ethnography, heard that Professor Nikolai Trubetskoy, who emigrated from Russia in 1920 and who was now teaching Slavic philology at Vienna University, had published a book in which he denied the existence of the pentatonic scale (the five-tone octave) in Western Europe. To check this information Kvitka decided to find this book and since it was not available in Soviet libraries, he borrowed it for a couple of days from some philologist friends. Soon after these friends were arrested along with other Slavic philologists, condemned ostensibly for participation in a 'Russian nationalist organization'. It is not surprising that Kvitka was also arrested and sentenced for three years in a Siberian camp. He was lucky to be released after two years for good behaviour — many people condemned for similar reasons were executed or died in the GULAG. He was even more fortunate to keep his job at Moscow State Conservatory. As any condemned person, he was forbidden to live closer than 100 km to Moscow. For many years he had to spend hours on trains almost every day to continue his musical research at the Moscow Conservatory.

fig 8.14 Leon Theremin. Photograph from his NKVD file. Moscow, Loubianka, 1939. Courtesy of Sergei Zorin.

LEON THEREMIN

On 10 March 1939, three months after his return to Russia, Leon Theremin was arrested and convicted 'for participation in the counter-revolutionary organization'[20] to eight years' hard labour in the stone quarries of the GULAG. In fact, if Theremin had had a better understanding of the political situation at that time, he could have avoided future troubles. There had been a big change in the Soviet intelligence services, with Lavrenty Beria just having come into power as a chief of NKVD, and a

20 Extract from report N26 of the Special Commission at the People's Commissariat of Internal Affairs (NKVD) from 15 August 1939. Published in the book by S. Kovaleva, *Lev Termen*, Moscow, Buro Quantum 2008, p. 190.

new generation of NKVD officers were busy removing their predecessors. But Theremin started to search for a job, visiting his former colleagues, who, in turn, were avoiding him as if he was infected with plague. Fortunately, after one year in Kolima (a brutal area in Siberia) he was transferred to the Moscow 'Sharaga' — a special NKVD prison for scientists. After his release in 1947 he continued working for the NKVD/KGB until his retirement in 1963 when he moved to the Acoustical Laboratory (formerly NIMI) at Moscow State Conservatory, in the unpaid position of head of a research group. In 1967 after the publication of the article about him in *The New York Times* he was removed from his position and fired from the Moscow State Conservatory. Theremin spent the rest of his life working at Moscow State University as a technician in the Physics Department. Leon Theremin died in Moscow on 4 November 1993.

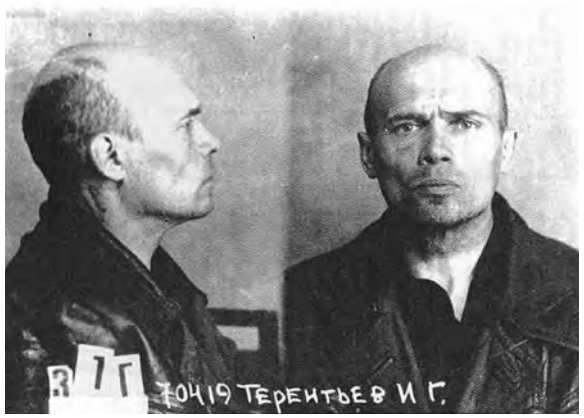


fig 8.15 Igor Terentiev. Photograph from his NKVD file. 1937. Moi pohoroni, Gilea, Moscow 1993.

IGOR TERENTIEV

In January 1931, poet and artist Igor Terentiev (former head of the Phonological Department at the Museum of Art Culture in Petrograd) was arrested. On 24 February he 'admitted' that he was a French spy, but soon after, on 13 March, he amended his statement: 'In all my previous statements, there was an essential discrepancy, namely, instead of "English counter-espionage" I indicated "French".' He was condemned to work on the construction of the Belomorkanal[21], where he supervised a team of prisoners assigned to theatrical propaganda. In 1933 he was released from the camp prior to his due release date. After that he was taken on as the head of the central propaganda team of the Dmitrov camp of NKVD that was working on the construction of the Moscow-Volga canal. Terentiev didn't succeed in his attempts to find another job.

On 28 May 1937 Terentiev was arrested again on false charges of conspiring to murder leaders of the Communist party and the government. On 17 June he was shot in Butirskaya prison in Moscow.

21 A ship canal in Russia opened on 2 August 1933. It connects the White Sea with Lake Onega, which is further connected to the Baltic Sea. The canal was constructed by means of the forced labour of GULAG inmates and during its construction some 8,700 people died.

fig 8.16 Mugshot of Vsevolod Meyerhold taken at his arrest. NKVD file, Moscow, Butirskaya prison, June 1939. http://en.wikipedia.org/wiki/File:MeyerholdMug.jpg

VSEVOLOD MEYERHOLD

Vsevolod Meyerhold was strongly opposed to socialist realism, and in the beginning of the 1930s, when Joseph Stalin clamped down on all avant-garde art and experimentation, his works were proclaimed antagonistic and alien to the Soviet people. His theatre was closed down in January 1938. He was arrested in Leningrad on 20 June 1939. His wife, actress Zinaida Raikh, was found dead in their Moscow apartment on 15 July 1939. Later that year he was brutally tortured in Sukhanovka[22] — a special prison also referred to as Sukhanovo in which inmates were regularly subjected to torture — and forced to make a confession that he had worked for Japanese and British intelligence agencies, which he later recanted in a letter to Vyacheslav Molotov. Meyerhold wrote:

The investigators began to use force on me, a sick sixty-five-year-old man. I was made to lie face down and beaten on the soles of my feet and my spine with a rubber strap...

For the next few days, while those parts of my legs were covered with extensive internal haemorrhaging, they again beat the red-blue-and-yellow bruises with a strap, and the pain was so intense that it felt as if boiling water was being poured on these sensitive areas. I howled and wept from the pain...

When I lay down and fell asleep after 18 hours of interrogation, in order to go back in an hour's time for more, I was woken up by my own groaning and because I was jerking about like a patient in the last stages of typhoid fever...

22 Sukhanovo special-regime prison was established by the NKVD in 1938 for 'particularly dangerous enemies of the people' on the grounds of the old Ekaterinskaya Pustyn Monastery near Vidnoe, just south of Moscow. Aleksandr Solzhenitsyn called it 'the most terrible prison the MGB had'. The Sukhanovka regime had the intention of driving its prisoners insane. Usually to start with, in order to break the will of the new inmates, they were forced for two days into small, closet-like cells in which they could not sit down or move. Following this, they would be beaten, often for many hours at a time and for days on end. After this inmates would be deprived of sleep and kept in solitary confinement. One of the survivors of Sukhanovka recounted fifty-two torture methods carried out at the prison.

'Death! Death is easier than this!'... I told myself. And so I started to slander myself in the hope that it would bring me to the scaffold ...' [23]

He was sentenced to death by firing squad on 1 February 1940. He was executed the following day.

fig 8.17 Alexei Gastev. 1930s. A photograph from the family archive.

ALEXEI GASTEV

On 8 September 1938 Alexei Gastev was arrested and taken to Lefortovo prison in Moscow. According to NKVD records, he had been caught undertaking anti-Soviet terrorist activities. In the first interrogation report dated 5 January 1939 he confessed to the accusation. According to the dates, statements and typical NKVD practices it can be assumed that Gastev was brutally tortured for almost four months, but the main pressure was exerted upon him in January 1939. On 26 January he changed his statements and essentially implicated a circle of people whom he described as 'participants in an underground anti-Soviet organization'. On 14 March 1939 the final report of the investigation and its completion was signed. Inspectors destroyed the documents and personal belongings of the prisoner. On 19 March the bill of indictment was signed. On 8 April a decision was taken by the Political Bureau to execute by shooting 198 people accused of being the leaders of 'the conspiratorial organization the Real Trotskyites'. On 13 April Gastev signed the bill of indictment. The next day the session of the Military Board of the Supreme Court of the USSR approved the indictment. Gastev declared that he 'deeply repents and asks the court to let him live'. On 15 April 1939 he was sentenced to execution with confiscation of all personal property. The same day, he was one of the group of forty-eight people shot to death in the suburbs of Moscow.[24]

23 Letter to V. Molotov on 13 January 1940. Published in *Vernite mne svobodu!* (Return Me a Freedom!) Memorial collection of documents from the former KGB archives, Moscow, 1997, p. 226-230.

24 The timeline, based on Gastev family documents, is published at http://www.pseudology.org/people/Gastev_AK.htm

EPILOGUE

There is no exact calculation of the number of victims of the Great Terror. Many documents are still kept in undisclosed FSB archives. Nevertheless, according to calculations by experts during the six years of the Great Terror (1 January 1935 — 1 June 1941) there were almost 20 million people arrested and about 7 million executed. This estimation doesn't include the victims of the previous period (including the famine during collectivization) as well as numerous casualties of World War II and post-war repressions. Some people chose to emigrate but many lost their lives in Stalin's torture chambers. Most survived through assimilation, deleting from their CVs any connections or affiliations to avant-garde or radical activity. By the late 1930s, the cultural and intellectual elite of the previous two decades had been rendered powerless or effectively written out of 'official' histories and excluded from the text books as though they had never existed. The last phase of Stalin's epoch was entirely fruitless for music technology. All the talent that emerged during this period in spite of the circumstances was directed to activity that preceded the recent developments. The new generation of engineers, living in cultural and informational isolation, was primarily engaged in attempts to copy or follow western developments. It became a time synonymous with poor-quality fakes and considerable frustration. No significant inventions were made in the realm of musical technology in Russia until the turn of the millennium.

Meanwhile, life since has confirmed the value and significance of the work and foresight of the lost pioneers. Many ideas and inventions, which at the time might have been considered as utopian, were reinvented decades later. We use them today not knowing their origins, and many ideas appear to still be awaiting fresh consideration. It leads back to the simple but eternal idea that was succinctly articulated by Russian poet and writer Joseph Brodsky in his address to humanity in his well-known Nobel Lecture: 'Regardless of whether one is a writer or a reader, one's task consists first of all in mastering a life that is one's own, not imposed or prescribed from without, no matter how noble its appearance may be. For each of us is issued but one life, and we know full well how it all ends...'[25]

25 Brodsky, J. Nobel Lecture December 8, 1987. Cited in 'Joseph Brodsky — Nobel Lecture'. Nobelprize.org 15 Dec 2011. www.nobelprize.org/nobel_prizes/literature/laureates/1987/brodsky-lecture.html

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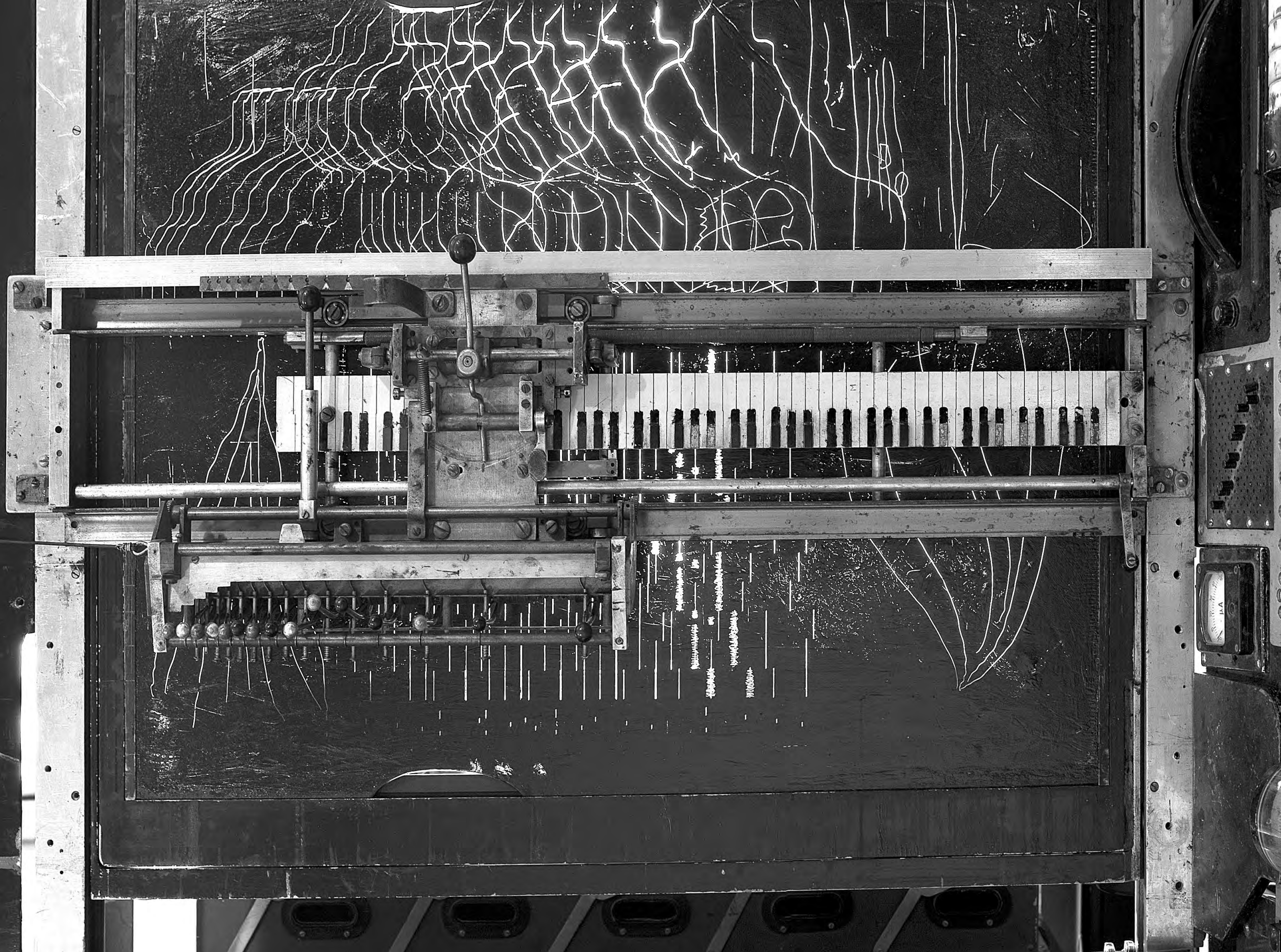
The publication *Sound in Z* developed out of an exhibition first presented under the same title at the Palais de Tokyo, Paris, in 2008 within the framework of the project 'From One Revolution to Another' by British artist and Turner Prize-winner Jeremy Deller. The exhibition *Sound in Z* (curated by Andrey Smirnov and Matt Price, assisted by Christina Steinbrecher) has subsequently been presented under the new title *Generation Z* in different forms around the world, and revolves around the archives and collections of Marina Sholpo, Hanna Reichenshtein, Andrey Smirnov, Lev Bolotsky, Sergei Zorin and Lydia Kavina, as well as the Russian State Documentary Film & Photo Archive, the Central State Museum of Musical Culture, named after Mikhail Glinka, the Moscow Polytechnic Museum, the Theremin Centre at Moscow State Conservatory, the State Tretyakov Gallery Archive, the Russian State Archive of Literature and Art (RGALI), and the State Museum of Contemporary Art (Thessaloniki, Greece).

Inside back cover image: The score with the coder of the ANS Synthesizer. TCA.



Russia, 1917 — a time of complex political upheaval that resulted in the demise of the Russian monarchy and seemingly offered great prospects for a new dawn of art and science. Inspired by revolutionary ideas, artists and enthusiasts developed innumerable musical and audio inventions, instruments and ideas often long ahead of their time – a culture that was to be cut off in its prime as it collided with the totalitarian state of the 1930s. Smirnov's account of the period offers an engaging introduction to some of the key figures and their work, including Arseny Avraamov's open-air performance of 1922 featuring the Caspian flotilla, artillery guns, hydroplanes and all the town's factory sirens; Solomon Nikritin's Projection Theatre; Alexei Gastev, the polymath who coined the term 'bio-mechanics'; pioneering film maker Dziga Vertov, director of the *Laboratory of Hearing* and the *Symphony of Noises*; and Vladimir Popov, the pioneer of Noise and inventor of Sound Machines.

Shedding new light on better-known figures such as Leon Theremin (inventor of the world's first electronic musical instrument, the Theremin), the publication also investigates the work of a number of pioneers of electronic sound tracks using 'graphical sound' techniques, such as Nikolai Voinov, Evgeny Sholpo and Boris Yankovsky. From eavesdropping on pianists to the 23-string electric guitar, microtonal music to the story of the man imprisoned for pentatonic research, Noise Orchestras to Machine Worshippers, *Sound in Z* documents an extraordinary and largely forgotten chapter in the history of music and audio technology.

'It is without doubt the best thing that I have ever read on the topic of graphical sound and synthesis, in either the historical or contemporary context. I feel many scholars of computer music and graphic sound will feel similarly to the way I felt when reading it – it's truly breathtaking'.

Dr. M. S. Grierson, Goldsmiths College, London

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