The Art of the THEREMIN

Clara ROCKMORE

"...the most original, novel and difficult to play of all electronic musical instruments. No other thereminist has ever come close to Clara Rockmore's artistry"

Robert A. Moog

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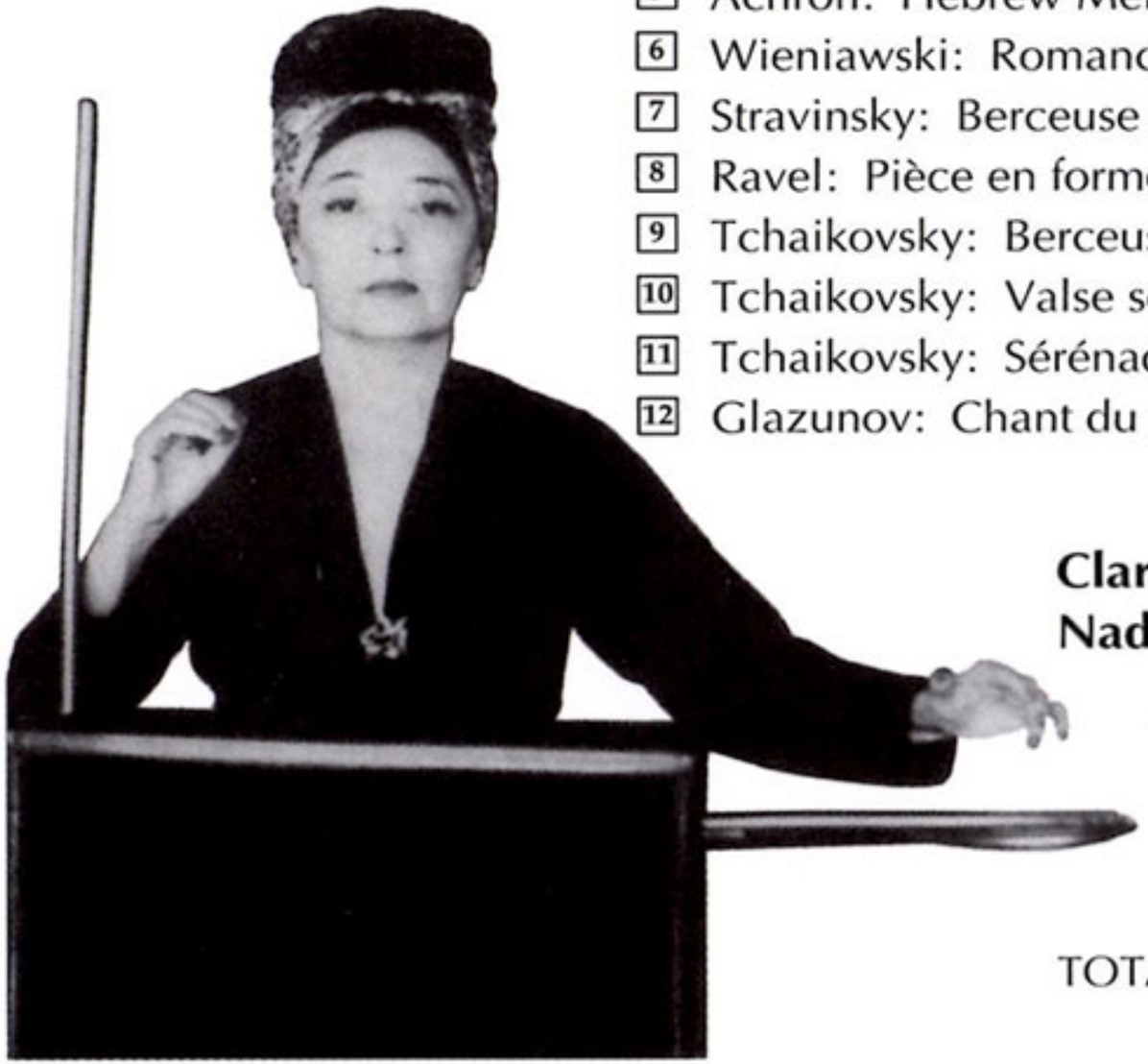
THE ART OF THE THEREMIN



1. Rachmaninoff: Vocalise (3:44)
2. Song of Grusia (4:15)
3. Saint-Saëns: The Swan (2:56)
4. De Falla: Pantomime (3:44)
5. Achron: Hebrew Melody (5:22)
6. Wieniawski: Romance (4:45)
7. Stravinsky: Berceuse (3:06)
8. Ravel: Pièce en forme de Habanera (2:41)
9. Tchaikovsky: Berceuse (4:12)
10. Tchaikovsky: Valse sentimentale (2:06)
11. Tchaikovsky: Sérénade mélancolique (7:40)
12. Glazunov: Chant du ménestrel (4:00)

Clara Rockmore, theremin
Nadia Reisenberg, piano

TOTAL PLAYING TIME: 64:02

Printed & Manufactured in USA

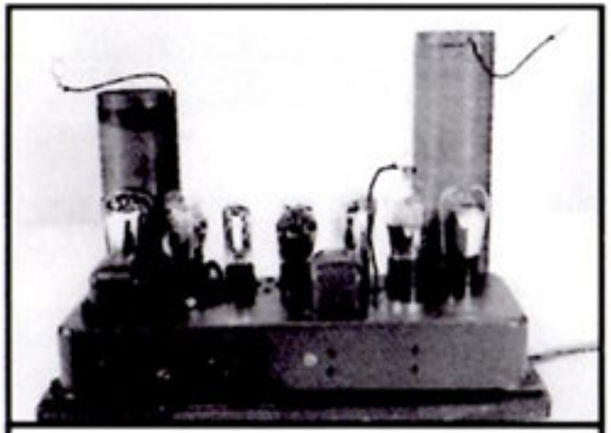
The theremin itself is housed in a wooden cabinet approximately eighteen inches wide and a foot deep. With its legs, it stands about three and a half feet high. The front is slanted to form a convenient music stand. A vertical pitch antenna rod is located in the upper right hand corner of the cabinet. A tubular loop for controlling volume emerges from the cabinet's left hand side. Tuning knobs and control switches are located on the lower part of the front of the cabinet.

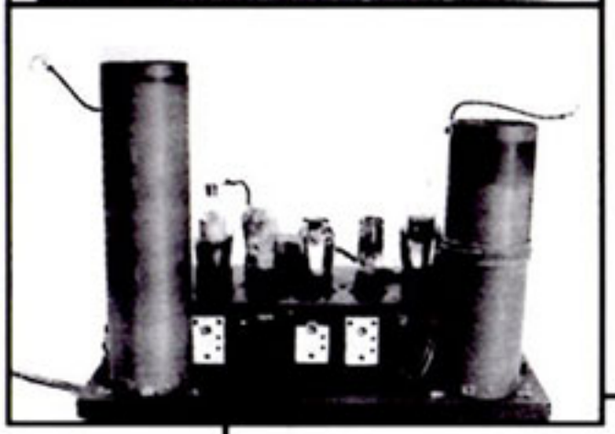
To play the theremin, the performer stands in front of the instrument, a little left of center. The feet are spread slightly to keep the body as motionless as possible. To determine the pitch of the instrument's tone, the player varies the distance between her right hand and the pitch antenna. When the instrument is properly tuned, the pitch goes from lower than two octaves below middle C when the player's right hand is back at her shoulder, to approximately 2 1/2 octaves above middle C when the player's hand barely touches the pitch antenna. To determine the loudness of the instrument's tone, the player varies the distance between her left hand and the middle of the volume antenna. Maximum loudness occurs when the hand is removed from the antenna; complete silence occurs when the hand is an inch or so from the loop.

The two antennas actually respond to all body movements. Therefore, it is necessary for the player to exert firm control over her body and head motions as well as her hand motions. The ability to stand motionless is absolutely essential. Concert-goers have remarked on Ms. Rockmore's controlled stance. One reviewer even wrote: "Miss Rockmore's seance-like management of this slightly supernatural instrument is quite amazing. Of course, the purpose of remaining still is not theatrical or hypnotic at all, but strictly musical."

The thereminist must move her hands with incredible precision as well as speed if she wishes to play distinct notes with correct intonation. Ms. Rockmore actually uses fingering patterns to play the most rapid passages. For instance, if she were to play an upward arpeggio, she would start on the lowest note with right hand tilted back and fingers withdrawn. To play the next note she would abruptly move her hand forward from the wrist, while keeping her right arm motionless. The third note would be played by rapidly extending the little finger, and the fourth note by extending one or two more fingers while simultaneously turning the wrist sideways to bring the newly-extended fingers nearer to the pitch antenna. She would then continue the arpeggio by moving her whole arm closer to the pitch antenna while drawing her hand and fingers back, then repeating the above-described succession of movements. At the same time, she may articulate each individual

Photos of main chassis of RCA Theremin





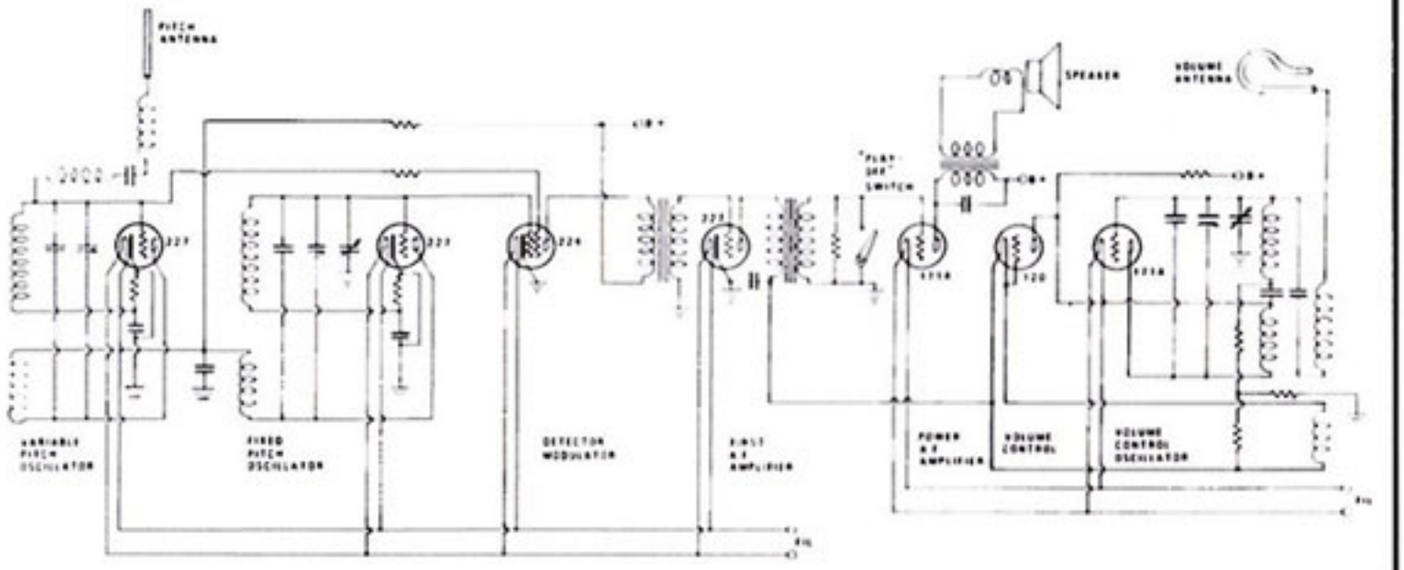


Diagram of circuitry of RCA Theremin except main power supply

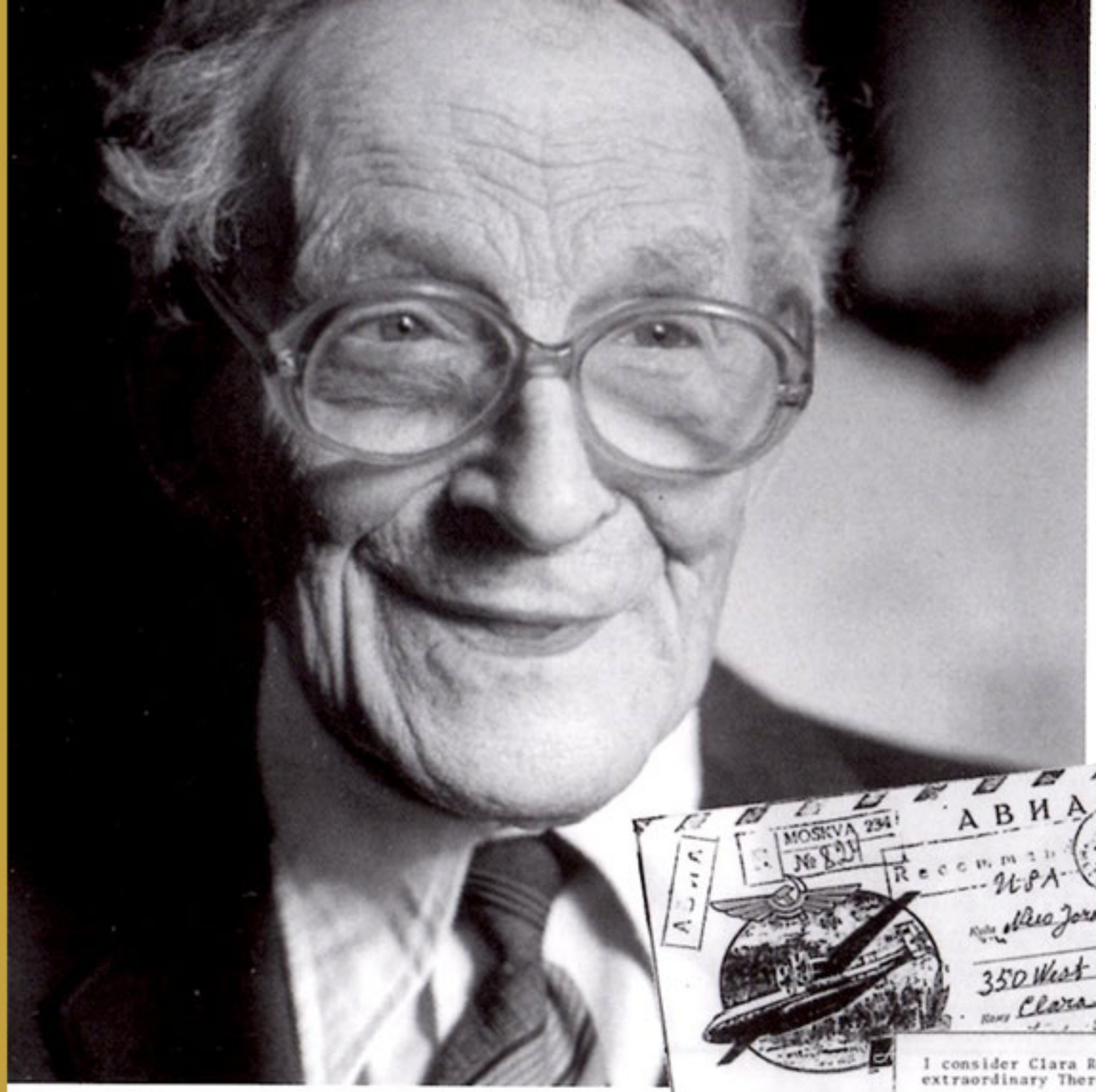
pitch by rapidly shooting the fingers of her left hand into the volume antenna loop, then withdrawing them, to silence the tone during the very short periods of time that her right hand moves from one pitch to another. No other theremin player has ever mastered this difficult and intricate technique for playing rapid successions of precise pitches — "aerial fingering" as one reviewer termed it.

The theremin performer plays without the benefit of any tactile reference whatever. Unlike a violinist, who is in constant contact with the instrument's fingerboard, or a clarinetist who feels the reed and keys, or even a singer who feels the vocal cords, the thereminist feels no shape or force as she moves from one pitch to another. She is constantly moving her hands, listening to the resulting pitch changes, then "trimming" the precise position of her hands to home in on the desired pitch and volume. The process is essentially one of continuous aural feedback. For this reason, placement of the theremin loudspeaker is extremely important. Ms. Rockmore uses a large, open-back speaker cabinet which she places behind and slightly above her head, pointing out toward her audience. With such an arrangement, she is able to hear the effect of her hand motions soon enough so that her audience is rarely, if ever, aware of the aural feedback corrections that she intuitively applies.

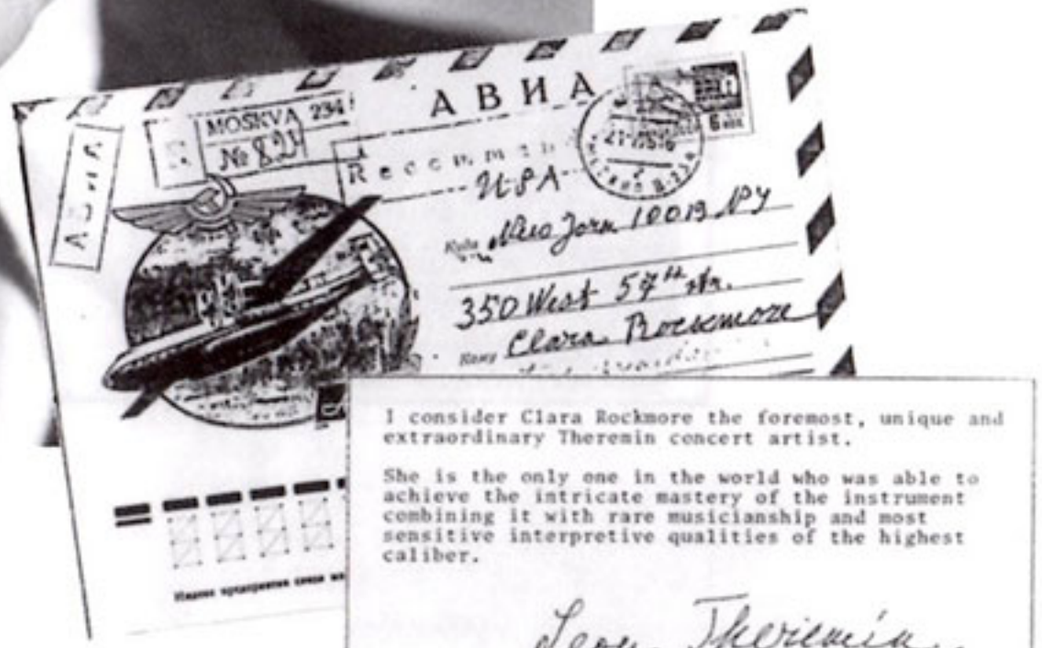
In 1927, two remarkable people arrived in the United States after lengthy and successful tours of Europe: Lev Sergeivitch Termen (anglicized to Leon Theremin) and Clara Rockmore (whose maiden name was Clara Reisenberg). Theremin was a young Russian physicist who was demonstrating a new musical instrument that he invented. The instrument, which he called the *aetherphon,* or *thereminvox,* and which later became known as the *theremin,* was played by the motion of the musician's hands in the space surrounding the instrument. Clara Rockmore, a professional violinist from the age of 9, became aware of the musical potential of Theremin's invention. She spent several years collaborating with Theremin during which time he developed his invention into a sensitive, wide-range musical instrument. Clara subsequently embarked on a performance career that encompassed well over a hundred concerts, including appearances with major symphony orchestras, and set the definitive standard for theremin performance technique.

Clara Rockmore was born in Russia, the youngest of three musically gifted sisters. Her oldest sister, Nadia Reisenberg, was a well-known concert pianist who recorded extensively and was for decades foremost in the ranks of piano pedagogues.

Clara was a true child prodigy, with absolute pitch and an uncanny sense of music. At the age of two, she could pick out



1987, Steve J. Sherman



I consider Clara Rockmore the foremost, unique and extraordinary Theremin concert artist.

She is the only one in the world who was able to achieve the intricate mastery of the instrument combining it with rare musicianship and most sensitive interpretive qualities of the highest caliber.

Leon Theremin.

PROF. LEON THEREMIN

A 1987 picture in Russia of the inventor, Professor Leon Theremin.

on the piano or sing any melody she heard - a lullaby sung by her mother, a piece played by her elder sister, or a song from a street-corner accordionist. Her career as a violinist began when her uncle gave her a quarter-size violin for her fourth birthday. At the age of 5 she was admitted as an exceptional student to the Imperial Conservatory of Music in St. Petersburg (now Leningrad). She was the youngest musician ever to have received this honor. Later she became one of Professor Leopold Auer's most promising pupils and, at the age of nine, received permission from the Russian government to leave her native land in order to concertize. The two sisters embarked on an extensive tour of Europe. Nadia often served as Clara's accompanist as well as playing her own piano solos. Finally, their recital circuit led them to New York City, where Clara met Leon Theremin for the first time.

Leon Theremin developed his aetherphon in Russia while he was a student at the University of Petrograd. In 1920, he demonstrated a working instrument at a convention of engineers and physicists. At that time, the vacuum tube had been in existence for only a few years; Theremin himself was only 21 years old! During the following years Theremin improved his instrument and staged a number of concert demonstrations. The first composer to use this new instrument was A. F. Paschtschenko. His composition, "A Symphonic Mystery" for theremin and orchestra, was premiered in May, 1924 by the Leningrad Philharmonic. In 1927, Theremin embarked on a European tour. His performances in Frankfurt, Berlin, London, and Paris were met with unrestrained enthusiasm. Listeners were amazed that the seemingly inaccessible technology of electronics had been harnessed to enable a musician to make music simply by waving his hands. At the Paris Opera, police were called to keep order among the crowds that thronged Theremin's concert- demonstration. For the first time in history, standing room was sold in the boxes.

By the time Theremin arrived in New York in December 1927, news of his fame had reached the rich and fashionable. His first "by invitation only" presentation included such notables as Edsel Ford, the Vincent Astors, the Fritz Kreislers, Rachmaninoff, and Toscanini. Demonstration concerts at the Metropolitan Opera House and the home of Cornelius Vanderbilt followed. Theremin set up a laboratory and studio in a fashionable midtown Manhattan residence, and proceeded to build new instruments and train performers. He and his new students joined the New York Philharmonic Symphony Orchestra on August 27, 1928, for a concert performance with four theremins and orchestra. An observer noted that the concert ended with " ...five minutes of persistent

applause that brought the rather constrained Russian back for a half dozen bows."

Among the noted musicians who heard the theremin in its early development was the celebrated Josef Hofmann. Several of his valuable suggestions were adopted by Theremin in later versions of his instrument.

On September, 1929, Theremin licensed the Radio Corporation of America to manufacture the thereminvox. RCA's "kickoff" promotion sought to assure the public that anyone who could hum or whistle could play their new product as well as a skilled musician. Of course, no expressive musical instrument can be played without extended, disciplined practice, during which the musician develops the technique necessary for effective control. Furthermore, the theremin, being played in space without reference to fingerboard, keys, or frets, requires that the performer have absolutely perfect pitch in addition to precise control over finger and hand motions. The RCA Theremin was not a commercial success. Although it was a solidly-built instrument with good tone color it was, simply put, hard to play. RCA attempted to sell their instrument through their regular dealers, most of whom were radio stores. Lessons were generally not provided. Indeed, few musicians outside of New York City knew even the basic fundamentals of theremin playing! After their initial production run of two hundred or so, RCA discontinued manufacturing the theremin.

One may conjecture that, at this point, Professor Theremin perceived the importance of developing artistic, professional theremin playing technique. During the few years after his arrival in the United States, Theremin trained many musicians to perform slow simple music on his instruments. However, the development of technique to perform pieces from the standard instrumental repertoire would require the dedication and effort of an unusually sensitive and talented performer. Clara Rockmore was this person. Clara worked intensively with Theremin's instruments, developing means for greater control and more precise articulation. At one of Theremin's concerts in 1932, Clara performed on an experimental dance platform called the *terpsitone.* The platform was equipped with thereminvox-like antennas, enabling the dancer to play a melody while dancing - the perfect synchronization of sound and motion. Clara recalls that Prof. Theremin asked her to perform on the platform, "because none of the dancers who tried it could carry a tune."

Ms. Rockmore gave her first solo theremin concert at New York's Town Hall, on October 30, 1934. Accompanied by her sister Nadia, Clara played the instrument that had been made to her specification by Prof. Theremin himself. Her technique coordinated precise arm and finger movements.

Left, Anna "Newta" Reisenberg with her sister, Clara Rockmore.

She played trills and pitch leaps with unprecendented accuracy. Her articulation took flowing phrases and rapid staccato passages in equal stride. And above all, her solid, natural musicianship held the audience spellbound, easily transcending the novelty aspects of the medium and of her playing technique.

During the twenty years or so following her theremin debut, Clara Rockmore toured widely, performing as guest soloist with major symphony orchestras, and made three coast-to-coast tours, sharing the program with the famous singer Paul Robeson. On several occasions she performed under the baton of Leopold Stokowski, one of her most enthusiastic supporters. Critics and audiences alike were amazed and delighted by Clara's exacting technique and brilliant musicianship. Upon hearing the 1945 premiere of Anis Fuleihan's "Concerto for Theremin and Orchestra," Harriett Johnson of the *New York Post* wrote: "Like most critics, it has been my fate to hear several concerts by thereminists, but none, in my opinion, has matched the superior quality of Miss Rockmore's performance last night."

Referring to Ms. Rockmore's performance of the formidable Cesar Franck Violin Sonata,"the *New York Times* commented: "What she accomplished in matters of intonation, legato, staccato playing, accentuation and nuances must have come as a distinct surprise to those who entertained false ideas of the theremin's possibilities. She evinced not only her exceptional control of every phase of theremin playing, but also a highly developed musical imagination and interpretive powers."

During the past few years, Ms. Rockmore has retired from active concertizing. Her appearances have been limited to a few radio interviews and private recitals. However, Clara maintains her enthusiasm for the theremin, and her masterful playing. She frequently points out that today's "space-conscious" listeners are interested in electronic music, "and what is more natural to electronic music than a space-controlled instrument?" She hopes that this disc, the first commercial recording of her playing, will acquaint today's listeners with the musical resources of the theremin, and with her own approach to the theremin as a musician interested in making music rather than just new sound effects.

HOW THE THEREMIN WORKS

A portion of the circuitry inside the theremin sets up low power, high frequency electromagnetic fields around the antennas. The player's hands alter the fields in proportion to how near they are to the antennas. The field alterations are magnified and then applied to change the pitch and volume of the instrument's tone. The description that

follows is written for those who wish to understand the electronic principles underlying the pitch and volume control in the theremin.

The tone-producing portion of the circuitry is known as a *beat frequence oscillator.* It consists of two separate oscillating circuits which operate at frequencies well above the range of human hearing. One of these runs at fixed frequency of about 170 kilohertz (thousands vibrations per second), while the other would operate within the frequency range 168-170 kilohertz. This second, variable oscillator is connected to the pitch antenna through a very large inductor. The pitch antenna has a small capacitance to ground. The antenna and inductor form a series resonant circuit, the natural frequency of which is slightly below 168 kilohertz. The series resonant circuit "loads" the variable oscillator, pushing its frequency up to 170 kilohertz (when the instrument is properly tuned). The very small amount of hand capacitance added to the pitch antenna by the performer when she brings her right hand near the pitch antenna (less than one picofarad!) is enough to substantially lower the antenna circuit's resonant frequency, thereby "unloading" the variable oscillator and allowing its frequency to drop to 168 kilohertz. Thus, as the performer brings her right hand near the pitch antenna, the variable oscillator frequency drops from 170 to 168 kilohertz, while the fixed oscillator remains at 170 kilohertz. A third circuit, called a detector or mixer, combines the two oscillator signals and extracts the difference, or beat, frequency of 0 - 2 kilohertz. The beat frequency is within the range of human hearing, and spans a pitch range of greater than five octaves.

The volume control circuit also uses a series-resonant antenna circuit which is connected to a high frequency oscillator. In the RCA theremin, the high frequency energy flowing in the volume antenna inductor is actually used to heat the filament of a vacuum tube, which in turn passes current to the tone amplifier stage. As the left hand approaches the volume antenna, the resonant circuit is detuned, the tube's filament is heated less, the tube passes less current to the amplifier, and the volume of the tone decreases. For a performer of Clara Rockmore's skill, this volume control scheme has a serious drawback: the tube's filament takes a certain amount of time to heat up and cool off, thereby limiting the rapidity with which tones can be articulated. Later models of Theremin's instrument use a faster-acting volume control circuit.

The waveshaping characteristics of the theremin bear special mention. A "textbook" beat frequency oscillator produces a pure sine waveform. Engineers regard the sine wave as "undistorted," and all other wave-

forms as "distorted." This is because non-sine waveforms contain extra frequencies called harmonics. Musically speaking however, high harmonic content is necessary for a rich, pleasing tone color. Prof. Theremin certainly recognized this requirement. The RCA theremin produces a "distorted" waveform that is remarkably similar in both shape and harmonic content to that of a bowed violin string! It is noteworthy indeed that Prof. Theremin, working in the 1920's without the benefit of an oscilloscope, possessed such an understanding of acoustics and a mastery of his technology.

OTHER DEVELOPMENTS OF PROFESSOR THEREMIN

Theremin remained in the United States for about ten years. During his stay he developed several musical instruments based on the beat frequency oscillator principle. In addition to perfecting his space-controlled aetherphon, he built keyboard- and fingerboard-controlled solo instruments, the terpsitone dance platform, the keyboard electronic tympani, and a keyboard-controlled complex rhythmic pattern generator. During the 1930's he staged several concerts using his instrument. The most ambitious was the March, 1932 Carnegie Hall concert, at which he presented a sixteen piece theremin electrical symphony. He also experimented with visual displays, including rotating discs illuminated with stroboscopic lights.

Theremin's experiments laid much of the groundwork for subsequent developments which led to many of the electronic musical instruments which are in use today. Unfortunately, the economic climate of the 1930's was not conducive to commercially profitable introduction of new musical instruments. Theremin returned to his native Russia around 1938. He continues to do research in electronic musical instruments and acoustics at the University of Moscow.

Robert Moog

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