



**Magic Music**  
from the  
**Telharmonium**



**The Story of the First Music Synthesizer**

A Color Documentary with Stereo Sound

Duration 28:51

Storyboard Script

Reynold Weidenaar

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## **Synopsis**

It was 1906. "Get Music on Tap Like Gas or Water" promised the headlines, and soon the public was enchanted with inventor Thaddeus Cahill's (1867-1934) electrical music by wire. The Telharmonium was a 200-ton behemoth that created numerous musical timbres and could flood many rooms with sound. Beginning with the first instrument, constructed in the 1890's, and continuing with the installation of the second instrument at Telharmonic Hall in New York, the rise and fall of commercial service, the attempted comeback of the third Telharmonium, and ending with efforts to find a home for the only surviving instrument in 1951, this documentary provides a definitive account of the first comprehensive music synthesizer.

## **Production Notes**

All visual sources are historically authentic still images. There are no live-action images, visual recreations, or mock-ups. The stills were photographed on transparencies and transferred to computer. Image processing and animation were created with Photoshop and Director on a PowerMac 8500 (144mb RAM). Most of the footage was generated in segments of 14 seconds or less. This was the upper limit of full-sized uncompressed PICT frames that the computer could fit into RAM and output at 30 frames per second. Custom 8-bit color palettes were produced for each segment. The segments were transferred from computer to 3/4-inch video, and from that to D2 video.

The dialogue is also authentic, taken from descriptions in newspapers and magazines of the day. Most of the music selections are known to have been performed on the instrument. However, no recordings of the Telharmonium have been located, so the music was recreated on a Yamaha TX802 Tone Generator, which permitted the use of just intonation where appropriate. The sound effects are generally from recorded libraries; some sounds of antique machinery and automobiles were also incorporated. The audio processing was accomplished primarily with SoundHack and Hyperprism; editing and mixing were achieved using Sound Designer, Deck, and Peak, on a Macintosh IIfx.

A history of the Telharmonium in print may be found in Weidenaar's book, *Magic Music from the Telharmonium*, Scarecrow Press, 1995, ISBN 0-8108-2692-5.

## **About the Producer**

Reynold Weidenaar was born in East Grand Rapids, Mich., in 1945. He studied composition with Donald Erb and Brian Fennelly, and began creating works for moving visuals and music in 1978 on 16mm film. His films and concert videos have received over 80 honors and awards. He has received Guggenheim and Fulbright fellowships in video and an N.E.A. composer fellowship. He is Assistant Professor of Communication at William Paterson University, Wayne, N.J.

## Credits

Script, Production, Direction, Still Camera, Image Processing, Computer Animation,  
Audio Recording, Music Arrangement, Digital Sound Design, Editing:

Reynold Weidenaar

Narration:

Brian Lehrer

Keyboard Performances:

Barbara Blegen

Additional Performance by Reynold Weidenaar

Voices:

Lisa Brenner

Elliott Crown

Dennis Heaphy

Roseanne Limoncelli

James Edward Pierce

Julia Pennington

Reynold Weidenaar

MIDI Music Production Engineers:

Alex Noyes, Harvestworks Inc. / Studio PASS

Mark Ramsey, Center for Electronic Music

Online Editing Engineers:

Nils Nichols and Topher Dune, through the Standby Program at Unitel Post 38

Music (in order of presentation):

- |                           |   |
|---------------------------|---|
| 1. Scott Joplin           | <i>Palm Leaf Rag</i>  |
| 2. George Frideric Handel | <i>Largo from Xerxes</i>  |
| 3. Felix Mendelssohn      | <i>Frühlingslied</i> , Op. 62, No. 6  |
| 4. Georges Bizet          | <i>March and Chorus from Carmen</i>   |
| 5. Ethelbert Nevin        | <i>Narcissus</i> , Op. 13, No. 4  |
| 6. Alphonse Czibulka      | <i>Songe d'amour après le bal (Intermezzo)</i> , Op. 356  |
| 7. John H. Flynn          | <i>Yip-I-Addy-I-Ay!</i>   |
| 8. Robert Planquette      | <i>Legend of the Bells from Chimes of Normandy</i>  |
| 9. Gustave Kerker         | <i>As She Played on the Cal-li-o-pay!</i> from <i>The Social Whirl</i>                          |
| 10. J. L. Molloy          | <i>The Kerry Dance</i>  |
| 11. Georg Goltermann      | <i>Andante from Concerto No. 5 for Violoncello</i>  |
| 12. G. A. Spink           | <i>I've Got to Dance Till the Band Gits Through (Bill Simmons)</i> from <i>The Social Whirl</i> |

13. Richard Wagner	<i>Prelude from Lohengrin</i>
14. Alfred G. Robyn	<i>The Rook and the Robin from Princess Beggar</i>
15. Victor Herbert	<i>Absinthe Frappè from It Happened in Nordland</i>
16. Karl L. Hoschna	<i>Every Little Movement Has a Meaning All Its Own from Madame Sherry</i>
17. Charles de Bériot	<i>Concerto No. 1 for Violin, Op. 16</i>
18. Lowell Mason	<i>Nearer My God to Thee</i>
19. Giacomo Rossini	<i>Andantino from William Tell</i>
20. Johann Strauss	<i>Du und du, Op. 367</i>
21. Ludwig van Beethoven	<i>Polonaise, Op. 8</i>
22. Ben M. Jerome	<i>Kiss Me Good-bye and Go, Jack</i>
23. Gustave Kerker	<i>It's Nice to Have a Sweetheart from The Tourists</i>
24. Pietro Mascagni	<i>Intermezzo from Cavalleria Rusticana</i>
25. Thomas Thompson	<i>Serenade</i>
26. Franz Lehár	<i>I Love You So (The Merry Widow Waltz)</i>
27. Richard Wagner	<i>To the Evening Star from Tannhäuser</i>
28. Reynold Weidenaar	<i>Telharmonia</i>
29. Scott Joplin	<i>Maple Leaf Rag</i>
30. Scottish Folk Song	<i>Auld Lang Syne</i>

**With the Support of:**

The National Academy of Recording Arts and Sciences, Inc., Hollywood, CA  
The Center for Electronic Music, New York, NY  
Harvestworks, Inc. / Studio PASS, New York, NY  
William Paterson University, Wayne, NJ

**Picture Sources:**

American Telephone and Telegraph Co. Corporate Archives  
AT&T Bell Laboratories  
Carnegie Hall Archives  
David Sarnoff Research Center  
Ella Merkel DiCarlo  
Holyoke Public Library  
The Maryland Club  
Robert A. Moog  
Museum of the City of New York  
New Jersey Secretary of State, Corporate Information and Records Section  
New York City Board of Estimate and Apportionment, Bureau of Franchises  
New York City Municipal Archives  
The New-York Historical Society  
The New York Public Library, Mid-Manhattan Branch, Picture Collection  
The New York Public Library, Performing Arts Research Center, Billy Rose Theatre Collection  
The New York Public Library, Performing Arts Research Center, Music Division

The New York Public Library, The Research Libraries, U. S. History, Local  
History & Genealogy Department  
Office for Metropolitan History  
Thomas L. Rhea  
Margaret Cahill Schwartz

Sound Effects Sources:

Harvestworks Inc. / Studio PASS  
Marilyn Reese

***Technical Information***

Sound Software:

SoundHack, Sound Designer, Hyperprism, Time Bandit, Reverb, Peak, Deck

Image Software:

Photoshop, Director

Hardware:

PowerMac 8500, Macintosh IIfx, Yamaha TX802 Tone Generator

Master Format:

NTSC Color D2 Digital Video

Release Formats:

NTSC (USA) System: VHS HiFi, 3/4-inch U-matic, BetacamSP  
PAL (European) System: VHS HiFi

**Scene 1: The Maryland Club**

**IMAGES**

**NARRATION & DIALOGUE**

**MUSIC &  
SOUND EFFECTS**



001  
Ballroom Dancers

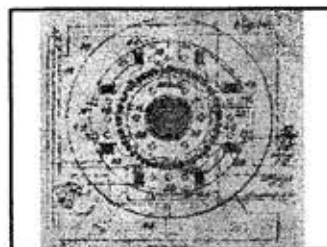


002  
Title



001  
Caption: Baltimore, 1900

A select group of affluent bankers and investors gathered for dinner at an exclusive private



003  
Dynamo Cross-Section

club to hear a business proposition for a revolutionary new invention.

*PALM LEAF RAG*  
by  
Scott Joplin.

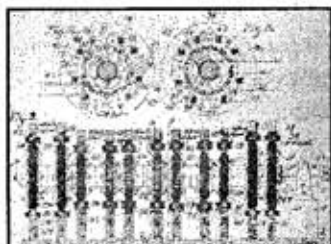




004

Telephone Receiver and Horn

A telephone receiver



005

Caption: Plan of Dynamos

fitted to a horn stood ready on the dining room table.



006

Top & Side of Dynamo Assembly

From this horn, the sound of the future would flood the room—the pure,



007

Top Rear of Dynamo Assembly

rounded tones of electrical music. A single pair of telephone wires transmitted



008

"Largo" Sheet Music

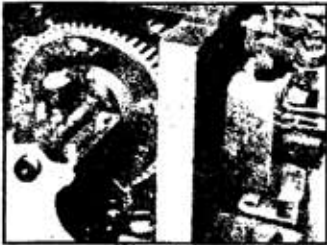
Handel's "Largo" as it was being performed on



009

Caption: The Telharmonium

the Telharmonium, 35 miles away.



010

End Rotor and Shaft

*LARGO*  
from  
*XERXES*  
by  
George Frideric  
Handel.

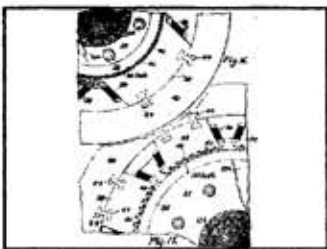
**MARKET FOR MUSIC** As a further illustration of the enormous need for musical tone the operators of these Companies, the following list of probable customers is given. These are the names of the principal firms in the world which are known to be connected with the business of selling musical instruments, and the number of instruments sold in each country in 1914.

Country	Number of Instruments Sold
USA	1,000,000
Canada	50,000
France	1,000,000
Germany	1,000,000
Italy	1,000,000
Japan	1,000,000
Spain	1,000,000
Sweden	1,000,000
Switzerland	1,000,000
U.S.S.R.	1,000,000
Other Countries	1,000,000
<b>Total</b>	<b>10,000,000</b>

011

Outlets for Wired Music

Before leaving the table, the awestruck businessmen would commit more than \$100,000.



012

Dynamo Teeth

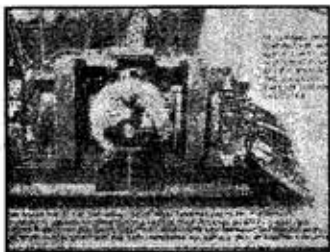
*"Sweet and clear over the wires."*



013

Broadside

It was only a down payment to finance a second, larger Telharmonium and purchase a license



014

Caption: End View of Dynamo

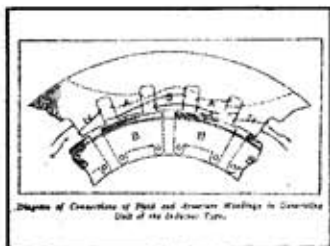
to operate the instrument in New York. Twenty years before the advent of radio,



015

Pamphlet

cable broadcasting



016

Dynamo Wiring

had become a reality.

SFX: Cork pops, champagne...



017

4 Men Toasting at Fireplace

*"It was pure music and it-it seemed to spring from nothingness—just a pair of wires."*

...pours, crystal glasses clink.

## Scene 2: Thaddeus Cahill Conceives and Builds the First Telharmonium



018

Caption: Thaddeus Cahill

Thaddeus Cahill was a young lawyer and an inventor of mechanisms for pianos and typewriters

*FRÜHLINGSLIED*,  
Op. 62, No. 6,  
by  
Felix Mendelssohn.  
SFX: Old typewriter.



019  
Cahill Typewriter

living in Washington, D.C.

SFX up.

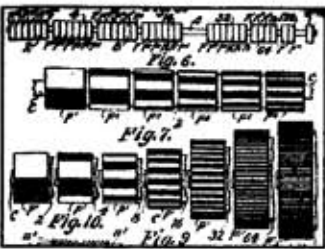
He was one of many who had experimented



020  
Trumpeter Plays into Telephone

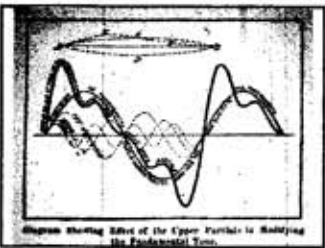
with transmitting music over the telephone system, but the sound had proven too thin and weak to fill a room.

SFX: Thin, weak trumpet.



021  
Rotors

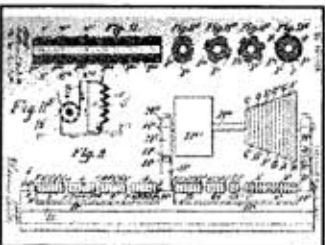
Electrical amplification was unknown. Then, in 1893, he was struck by a grand and radical idea. Why not build up



022  
Waveforms of Harmonics

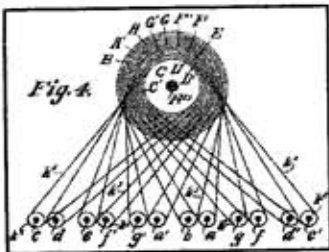
complex musical tones directly from a set of electrical generators?

SFX: L ch. - sweep of harmonic series.  
R ch. - electrical generator static.



023  
Side View of Mainframe

It would be the perfect music machine. It would possess all the strengths of every instrument



024

**Caption:** A Drive Belt for Every Pitch Shaft

with the defects of none.

Cahill envisioned transmitting music



025

**Telephone Receiver and Horn Suspended in Trees above Outdoor Café**

from what he called a central station to tens of thousands of places at once, over a network of telephone lines. During the late 1890's, he slowly built, by hand, a small version of this astounding instrument.

**SFX: Buzz of conversation, women talking.**

*MARCH AND CHORUS*  
from  
*CARMEN*  
by  
Georges Bizet.



**Telharmony**

026

**Winged Lyre**

Completed, it was to weigh 14,000 pounds. Nothing like it had ever been seen or heard before.



027

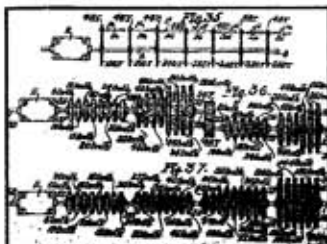
**Caption:** George Westinghouse, Lord Kelvin

He showed the Telharmonium to George Westinghouse and the Scottish scientist Lord Kelvin,



028  
Lord Kelvin

who was delighted: *“One of the greatest accomplishments of the brain*



029  
Caption:  
The Teeth on the Dynamos

*of man.”*

Cahill began to look for money to build a larger version. He demonstrated it for Oscar T.



030  
Caption: Oscar T. Crosby

Crosby, a prominent Washington capitalist and a well-known world explorer.

MUSIC up.



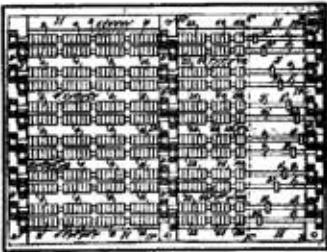
031  
Telephone Operator at Globe

Crosby hungrily predicted enormous profits, on the scale of the telephone's.



032  
Top of Dynamo Assembly

He decided to back Cahill financially and take control of the enterprise. When the two of



033

**Caption:** Overhead Sketch of Dynamo Shafts

them succeeded in transmitting electrical music to the Maryland Club, potential investors



034

**Wall St. Lambs Selling Stocks**

plainly saw the fortune to be made in sending long-distance music



035

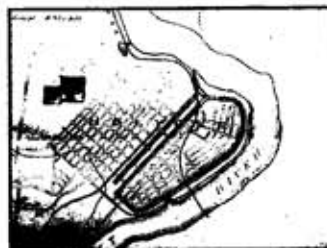
**Caption:** The Music Room of the Future

everywhere—to hotels and clubs, to restaurants and theatres. SFX: Restaurant ambience.

*“Of an exceedingly high class.”*

*“Positively hair-raising because of its novelty.”*

### **Scene 3: Holyoke**



036

**Map of Holyoke Canals**

In the summer of 1902, Crosby sent Cahill to Holyoke, *NARCISSUS*, Op. 13, No. 4, by Ethelbert Nevin.



037

Holyoke Skyline at Night

Massachusetts, to build the second Telharmonium. The busy mill town



038

Mills on the Second-Level Canal

had scores of machine factories.

SFX: factory roar.



039

George F. Cahill

Cahill, with his



040

Arthur T. Cahill

brothers, George and Arthur, set up a workshop in the Cabot Street mill.

**Scene 4: Edwin Hall Pierce and the Completion of the Second Telharmonium**



041

Caption: Edwin Hall Pierce

As the second Telharmonium was nearing completion, Thaddeus Cahill hired

*SONGE D'AMOUR*  
*APRÈS LE BAL*  
*(INTERMEZZO)*,  
Op. 356,  
by  
Alphonse Czibulka





042

Caption:

Pierce at the Telharmonium

Edwin Hall Pierce and two other local musicians to play the new instrument. They began to develop various sound qualities,



043

Musical Instruments

boldly hoping to duplicate the instruments of the orchestra. Pierce's son



044

Caption:

James Pierce in 1906--Age 10

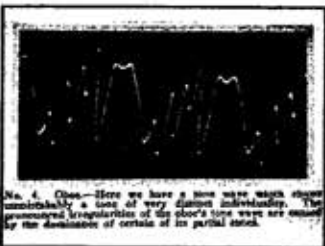
James was ten years old when the great machine was completed in 1906. He could remember listening



045

Caption: James Pierce in 1974

to the Telharmonium: *"Just what the sound of it was, as I recall it was something resembling an organ, a pipe organ,*



046

Caption: Oboe Oscillograph

*course they could sound like various different instruments. It was, it*



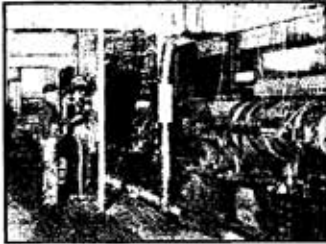
047

Caption: Mill Worker  
with Dynamo Rotor

*must have been at least 40 or 50 feet long. Cutting the gears, heh-heh, cutting the teeth in these wheels and things like that, I can remember seeing 'em do that in the shop there where they were working."*

SFX: milling and grinding.

### Scene 5: The First Performances

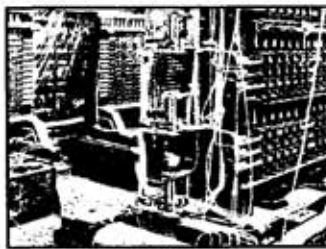


048

Workman with Dynamos

The mainframe of the instrument was 60 feet long, and the

*YIP-I-ADDY-I-AY!*  
by  
John H. Flynn



049

Switchboards

mighty giant weighed 200 tons. Ten switchboard panels were jammed with nearly 2,000

SFX: switches,...



050

Caption: Thaddeus Cahill

switches.  
(PAUSE)

...relay clicks, transformer hum.

Thaddeus Cahill had spent \$200,000 to build his central station full size.

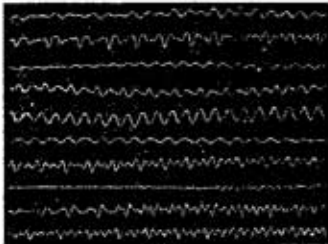
The first performances were given



051

Caption: Hotel Hamilton

at the Cabot Street Mill in Holyoke and transmitted to the grand ballroom of the Hotel Hamilton, half a mile away.



052

Waveforms

The entire ballroom was filled with sound, despite the absence of electronic amplification,



053

Captions: Tone Mixer,  
Arthur Cahill

because the output of a single generator on the central station was as great as 14,000 watts.

(PAUSE)

The guests were enthralled.



054  
Woman with Cigarette



055  
2 Women in White



056  
Woman Wearing Straw Hat



057  
Newspaper Story



058  
Caption: Switchboard

<— Set of pictures displayed completely simultaneously on screen.

MUSIC up.

*“Extraordinary—and delightful.”*

Sometimes, however, the wires delivered a distorted and annoying sound—the tones

would start with a click, as though a metal hammer were striking a string.



059

2 Performers at Keyboard

*“All the notes were inaugurated with little explosive puffs.”*

### **Scene 6: Off to New York**



060

Caption: New York

In the summer of 1906, the

*LEGEND OF THE BELLS*  
from  
*CHIMES OF NORMANDY*  
by  
Robert Planquette.



061

Aerial View of New York

Telharmonium was dismantled and transported to New York. The instrument was re-assembled and installed

SFX: machine assembly.



062

Captions: Times Tower,  
Broadway Building

a few blocks south of Times Square in the Broadway Building.  
(PAUSE)

SFX up.



063

Broadway Building

The alternators and switchboards were set up in the basement. The keyboards were housed in a new auditorium constructed on the



064

Metropolitan Opera House

ground floor.

The Broadway Building stood opposite the Metropolitan Opera House and the glittering Casino Theatre. This



065

Casino Theatre



066

Caption: "The Rialto"

expensive stretch of Broadway was known as "The Rialto," the heart of the theater district and a mecca for the



067

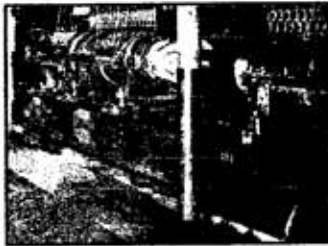
Caption: Leaving the Opera

cream of fashionable high society.

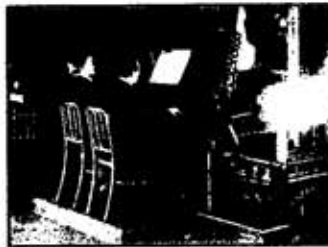
## Scene 7: Playing the Infernal Contraption



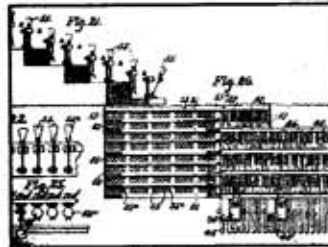
068  
Console with Sign



069  
Caption: Dynamos



070  
2 Performers at Keyboard



071  
Caption:  
Timbre-Control Switches

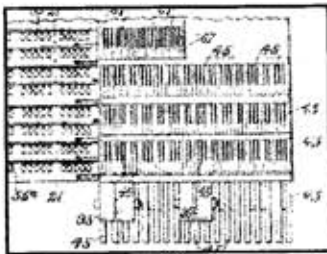


072  
Performer and Switches

The Telharmonium was a performer's nightmare come true. It was the most hair-raisingly complicated instrument to play in all the

*AS SHE PLAYED ON THE CAL-LI-O-PAY!*  
from  
*THE SOCIAL WHIRL*  
by  
Gustave Kerker.

history of music. Usually, two musicians played at one time. One would play the bass line and accompanying chords, set his own timbre-control switches, and set some



073  
Keyboard and Pedalboard



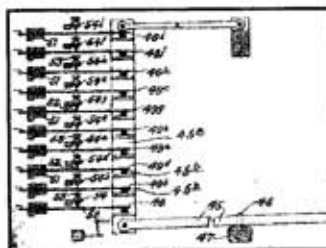
074  
Performer at Keyboard



075  
2 Performers at Keyboard



076  
2 Performers at Keyboard



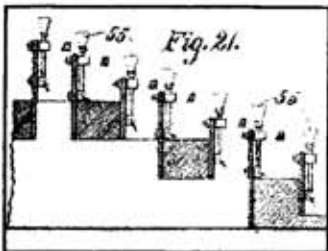
077  
Caption: Key Switches

of his partner's. He would also operate a swell-pedal and a separate dynamic manual to control the overall volume. The other musician played the melody and treble harmonies. He

constantly stretched his reach to create just-intonation intervals and to span four

keyboard banks. It was a torment to move around the keyboard, since black and white keys

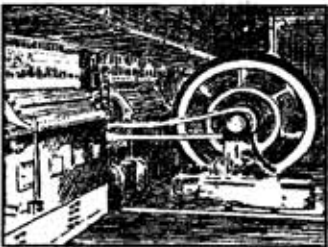




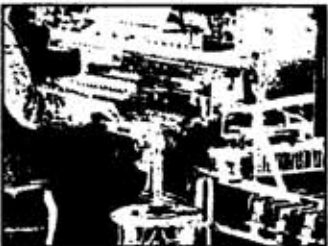
078  
Timbre-Control Switches



079  
2 Performers at Keyboard



080  
Caption: Drive Motor & Belt



081  
Console with Telephone

alternated one-for-one. He would also operate his own swell-pedal, along with the remainder of the timbre-control switches. The musicians needed to adjust a master tuning control

when the drive motor began to slow down and the pitch drifted.

MUSIC up. Pitch drifts down a perfect fifth.

They could always phone for help.

SFX: antique telephone rings.

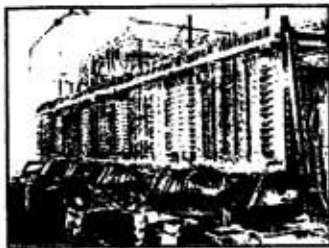
**Scene 8: The First Preview Concert in New York**



082  
Caption: N.Y. Riverfront



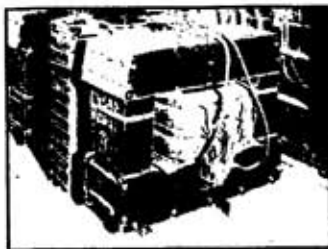
083  
Caption: Telharmonic Hall



084  
Switchboards



085  
Transformers



086  
Big Transformer

The first preview concert in New York was presented in September of 1906. Before the concert, a crowd of 900

*THE KERRY DANCE*  
by  
J. L. Molloy.

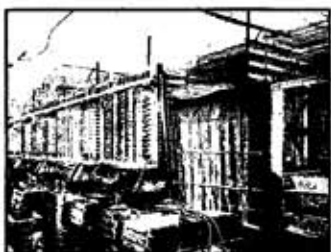
SFX: transformer hum, switchboard clicks, dynamo roar.

guests filed into the machinery rooms in the basement, to marvel at the transformers, switchboards, and dynamos.

(PAUSE)

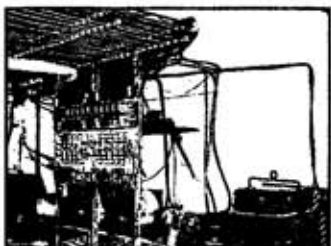
SFX up.

During the concert, technical inadequacies were evident. The bass was thin and the treble had a dull sound. It was ironic—the massive instrument seemed best suited to small



087

Switchboards, Wires on Ceiling



088

Knife Switchboard

pieces of a gentle and unassuming character.

*“Like a church organ, much softer and sweeter.”*

### Scene 9: Music in Fashionable Restaurants



089

Ritz-Carlton Roof Garden

Fashionable restaurants were springing up all over New York, a diversion for the new industrial rich. Many of the finest restaurants were in prominent

*ANDANTE*

from

*CONCERTO NO. 5*

*FOR VIOLONCELLO*

by

Georg Goltermann.



090

“A Cozy Nook”



091

Hotel St. Regis Dining Room



092

Caption: The Plaza



093

Caption: Waldorf-Astoria



094

Plaza Hotel Dining Room



095

"At a Fashionable Hostelry"



096

"The Orpheus of the Restaurant"

hotels, among them the Victoria, the Plaza, and the

Waldorf-Astoria.

SFX: restaurant  
ambience.

Huge menus would come to feature more than 500 items. Some establishments

boasted four orchestras, each with 30 musicians. Restaurant performers ranked among the best and highest-paid players Europe could offer. The combined salaries

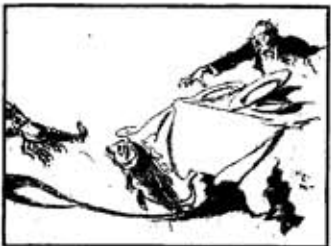
of New York restaurant musicians exceeded a million dollars in one year.



097

"Orpheus" -- Chicken, Lobster

Replacing them with his new service was the goal of Oscar T. Crosby and his



098

"Orpheus" -- Fish, Diner

New York Electric Music Company.

MUSIC up.



099

Hotel St. Regis Dining Room

*"Absolutely perfect and beautiful music by the best musicians upon the only perfect musical instrument."*



100

"Private Party Cellar"



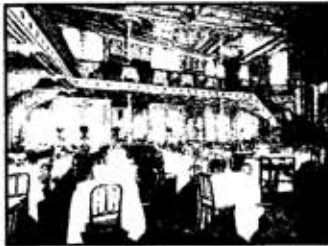
101

American Theatre Roof Garden

**Scene 10: The Café Martin and the Singing Arc**



102  
"All Roads Lead to Café Martin"



103  
Café Martin,  
Table d'Hote Dining Room



104  
Café Martin Building



105  
Café Martin  
Display Advertisement



106  
Hooker

Telharmonium service to the Café Martin on Madison Square was inaugurated in November 1906.

*I'VE GOT TO DANCE  
TILL THE BAND GITS  
THROUGH (BILL  
SIMMONS)  
from  
THE SOCIAL WHIRL  
by  
G. A. Spink.*

The foyer of this elegant Parisian establishment attracted ladies who, for professional



107

Couple Outside Flatiron Building

reasons, seldom disdained invitations to an evening's diversion.

SFX: L ch. - male  
"ho-ho-ho." R ch. - female giggle.

At first the



108

"Talking It Over Quietly"

F-sharps from the Telharmonium blared shrilly. A defective diaphragm was quickly replaced,

MUSIC: distorted f#.



109

Enraptured Lady Diner near Horn on Wall

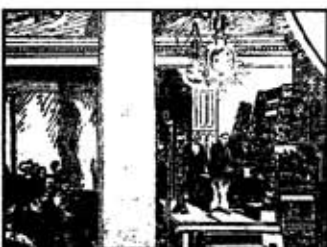
and it seemed to the delighted patrons that, clearly, here was an instrument that would purvey "music to the million."



110

Happy Woman Raising Sherry Glass

After the Café's inaugural dinner, the honored guests repaired to Telharmonic Hall. Here



111

Gathering at Telharmonic Hall with 2 Arc Lamps [DRAWING]

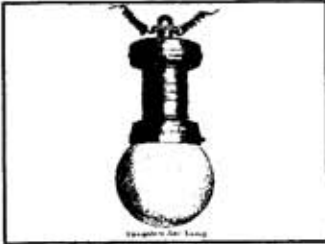
they were treated to a demonstration of the "singing arc"—two arc lamps connected directly to the Telharmonium. As they glowed with light,



112  
Gathering at Telharmonic Hall  
with 2 Arc Lamps [PHOTO]

the lamps acted as small  
loudspeakers, oscillating with  
music.

MUSIC up.



113  
Caption: Tungsten Arc Lamp

*“A strange reality of this  
golden age of electricity.”*

**Scene 11: Mark Twain**



114  
Hands on Keyboard

*PRELUDE*  
from  
*LOHENGRIN*  
by  
Richard Wagner.



115  
Mark Twain

Early in December, Mark  
Twain visited Telharmonic  
Hall: *“Every time I see or  
hear a new wonder*



116  
Mark Twain Writing in Bed

*like this, I have to postpone  
my death right off. I couldn't  
possibly leave the world until  
I have heard this again and  
again.”*



**Scene 12: The Casino Theatre**



117  
Casino Theatre



118  
Casino Theatre Auditorium



119  
Casino Theatre Program



120  
Casino Theatre Audience



121  
Casino Theatre Program

*THE ROOK AND THE ROBIN*  
from  
*PRINCESS BEGGAR*  
by  
Alfred G. Robyn.

Just after New Year's Day, the New York Electric Music Company connected the Telharmonium to the massive, ornate, and

ostentatious Casino Theatre. The Casino was a luxurious temple for fluffy and

frollicsome musical productions.

SFX: audience ambience.

It was the primary gathering place where privileged young men could survey a showcase of feminine bloom.



122  
"The Social Whirl"  
Five Girls on Railing

For an hour before the curtain  
rose



123  
"The Social Whirl"  
Display Advertisement

on the huge chorus, the pretty  
and shapely women, and the  
bubbling



124  
A Corridor of the Casino Theatre

gaiety, audiences were de-  
lighted with the Telharmo-  
nium. The electrical music  
was piped into



125  
Full Cast of "The Social Whirl"

the gilded lobby, before the  
musical comedies and during  
intermissions.

*"Sweet*



126  
"The Social Whirl"  
The Manicurists



127  
"The Social Whirl"  
The Manicure Ballet



128  
"The Social Whirl"  
The Shoeshine Girls

*and rounded music"*  
*"Great*

*penetrating power."*

**Scene 13: The Gala Reception**



129  
Display Advertisement

In January 1907,

*ABSINTHE FRAPPE*  
from  
*IT HAPPENED IN*  
*NORDLAND*  
by  
Victor Herbert.



130  
Invitation to First Public Recital

Telharmonium Hall finally announced that concerts would be open to the public. A long list of distinguished guests attended the gala formal reception.



131  
Caption: Victor Herbert

Present were composer Victor Herbert,



132  
Caption: Spencer Trask

banker Spencer Trask,



133  
Caption: George Foster Peabody

financier George Foster Peabody,



134  
Caption: Walter Damrosch

conductor Walter Damrosch,



135

Caption: Clyde Fitch

playwright Clyde Fitch,



136

Caption: Peter Cooper Hewitt

and inventor Peter Cooper  
Hewitt.  
(PAUSE)

MUSIC up.

Crosby



137

Caption: Hotel Normandie

grandly announced that the  
Hotel Normandie, on Broad-  
way and Thirty-eighth Street,  
and the magnificent Waldorf-  
Astoria, on Fifth Avenue

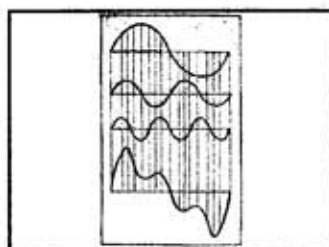


138

Caption: Waldorf-Astoria  
Bedroom of Royal Suite

and Thirty-third, had just sub-  
scribed to his Telharmonic  
service.

MUSIC up.



139

Waveforms of  
Additive Harmonics

*“Clear, sweet, perfect  
tones.”*

*“Long, sustained, perfect  
tones.”*

**Scene 14: Concerts at Telharmonic Hall**



140

Auditorium of Telharmonic Hall

Inside Telharmonic Hall, music played from horns hidden in the circular divan, the ceiling, ferns and shrubs, columns, and urns.

*EVERY LITTLE MOVEMENT HAS A MEANING ALL ITS OWN*  
from  
*MADAME SHERRY*  
by  
Karl L. Hoschna.



141

Sheet Music Cover

The prestigious Elliott Schenck was named the new music director, and replaced the little-known and expendable Edwin Hall Pierce



142

Elliott Schenck

MUSICAL PROGRAM			
SELECTION 1	1:00 P.M. Selection: Nocturne in E flat	Chopin	
	1:15 - - - - - Scherzo in D major	Chopin	
	1:30 - - - - - Mazurka, "Ballade"	Chopin	
	1:45 - - - - - Polka for E minor	Chopin	
SELECTION 2	2:00 P.M. Selection: Norwegian Folk Song	Edvard Grieg	
	2:15 - - - - - First Nocturne	Chopin	
	2:30 - - - - - Second Nocturne	Chopin	
	2:45 - - - - - Scherzo	Chopin	
SELECTION 3	3:00 P.M. Selection: "Waltz No. 1"	Chopin	
	3:15 - - - - - Nocturne in E flat	Chopin	
	3:30 - - - - - Scherzo	Chopin	
	3:45 - - - - - Polka for E minor	Chopin	
SELECTION 4	4:00 P.M. Selection: Introduction	Chopin	
	4:15 - - - - - Nocturne	Chopin	
	4:30 - - - - - Mazurka	Chopin	
	4:45 - - - - - Scherzo	Chopin	

143

Program: List of Music

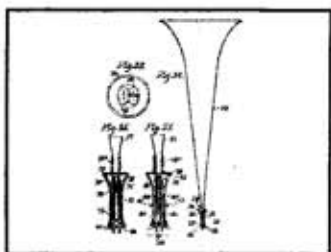
With nine pieces at each of four daily concerts, it became difficult for the musicians to find enough time to practice, and it wasn't long



144

Waveforms

before the quality of performances became inconsistent.



145  
Receivers and Horn

Meanwhile, Thaddeus Cahill plodded on in Holyoke, working on improvements.

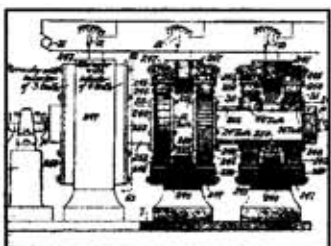
**Scene 15: The Heyday of the Telharmonium**



146  
Winged Lyre

February 1907 was the heyday of the Telharmonium. At the unveiling, critics had noted that Telharmonic music

*CONCERTO NO. 1  
FOR VIOLIN,  
Op. 16,  
by  
Charles de Bériot.*



147  
Side View of Alternators

was deficient: *“Rather crude and lacking in variety. Also, certain tones are over-accented.”*



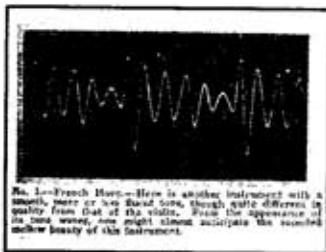
148  
Display Advertisement

Yet, in the space of a few weeks, it had become a popular novelty, and hundreds filled Telharmonic



149  
Program No. 1

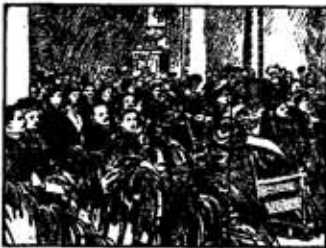
Hall for each concert. The New York newspapers daily carried



150  
French Horn Oscillograph



151  
Audience at Telharmonic Hall  
[PHOTO]



152  
Audience at Telharmonic Hall  
[DRAWING]



153  
Elliott Schenck at Keyboard



154  
Woman Sings into Telephone

glowing reports. The hall featured exciting demonstrations of “tone building”—the

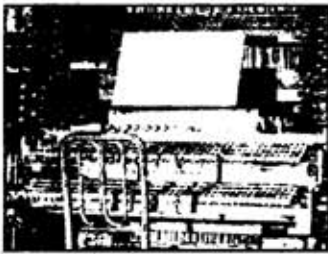
SFX: concert hall audience ambience.

sounds of the different acoustic instruments as they were built up

from scratch. Vocalists sang and a violinist played along with the instrument in the hall, but at first, only the keyboard music was transmitted

over the wires. After a few weeks, Broadway singer Isabelle Winlocke was hired to record gramophone records for the telephone transmission of vocals along with the Telharmonium.





155

Telharmonium Console

*“A blend of woodwind and brass, with a peculiar twang of its own.”*

**Scene 16: The Lenten Gospel Service**



156

Hotel Victoria

Many of the new hotels purchased the service—the Victoria, on Broadway



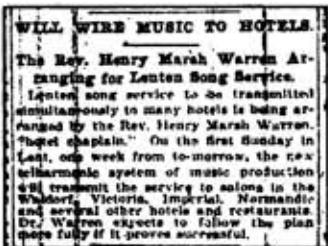
157

Hotel Imperial

and Twenty-seventh, and the Imperial, on Broadway and Thirty-first, among them.

The latter was the site of the great Telharmonium

*NEARER MY GOD TO THEE*  
by  
Lowell Mason.



158

Newspaper Story

Lenten revival service led by the Reverend Henry Marsh Warren. As the good preacher announced the hymns in the hotel meeting room, the performer at Telharmonium Hall was cued to begin by



159

Gospel Service at Hotel Imperial

telephone. At a simultaneous service at Telharmonium Hall, the hymns were sung and transmitted to the subscribing hotels.



160  
Rev. Henry Marsh Warren

L ch: "When the musical Redeem-  
R ch: "Our Father,  
L ch: er comes, he will be  
R ch: who art in heaven,  
L ch: able, by means of  
R ch: hallowed be thy name,  
L ch: the Telharmonic system,  
R ch: thy kingdom  
L ch: to draw unimagined harmonies  
R ch: come, thy will be done, on earth  
L ch: from the caves of sound."  
R ch: as it is in heaven."

**Scene 17: Radio Broadcasts by Lee de Forest**



161  
Caption: Lee de Forest

Lee de Forest was an ambi-  
tious young

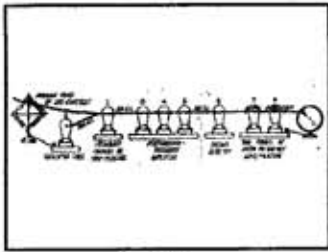
*ANDANTINO*  
from  
*WILLIAM TELL*  
by  
Giacomo Rossini.



162  
De Forest Wireless Apparatus

inventor who had been exper-  
imenting with radio transmis-  
sions for

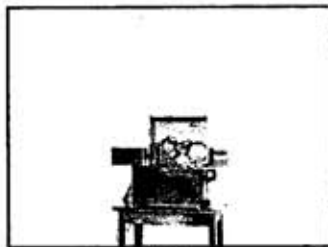
SFX: antique radio  
tuning, static, pops,  
whines.



163  
Radio Signal Path



164  
The Audion



165  
De Forest Receiver



166  
Yale Club



167  
Brooklyn Navy Yard

six years. He had just invented the three-element vacuum tube—the triode, or audion.

In February 1907, he persuaded a skeptical Oscar T. Crosby to let him broadcast

the Telharmonium. He set up his radio receiver on the roof of the Yale Club, an eleven-story building on Forty-fourth Street. The electrical music would come through the air, but so would interference in the form of Morse code

SFX: Morse code.

from steamships in the harbor.  
(PAUSE)

SFX: steamship horn, bell.

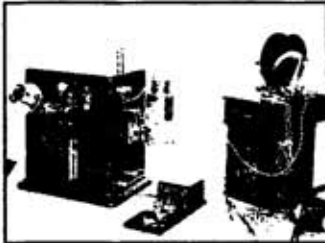
Next, de Forest put his



168  
Broadway and Times Tower

apparatus on the top floor of the Times Tower, a skyscraper on Forty-third Street. But accompanying the music were

SFX: several telegraphs.

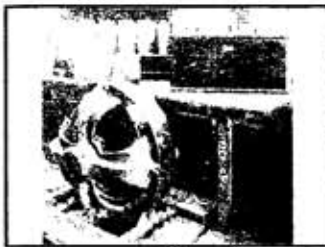


169  
De Forest Radio Apparatus

radio telegraph signals from the Brooklyn Navy Yard and as far away as Bridgeport, Connecticut.

De Forest continued broadcasting from Telharmonic Hall for several months, but static, dropouts, and frying noises made reception

SFX: add static.



170  
De Forest Transmitter

undependable. De Forest nevertheless tried to peddle his system to the New York Electric Music Company, but Crosby declined.

SFX up.

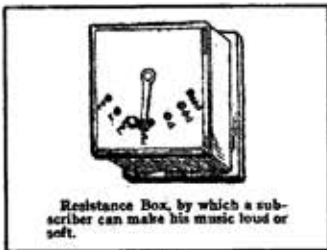
**Scene 18: The Close of the First Season**



171  
Display Advertisement

In April the Hall announced the end of its first season. The final program was a multi-channel extravaganza featuring different sounds from various locations

*DU UND DU,*  
Op. 367,  
by  
Johann Strauss.



Resistance Box, by which a subscriber can make his music loud or soft.

172

Resistance Box

in the auditorium. Portable volume controls were carried through the audience, and the enchanted patrons were invited to operate them.

*“As sensitive to moods and emotions*



173

Woman on Telephone

*as a living thing.”*

Motion pictures demonstrated to potential subscribers how to request musical selections by telephone.

After the



174

Report

Hall closed, the New York City Board of Estimate offered a cable franchise to Crosby for a hefty \$675,000.

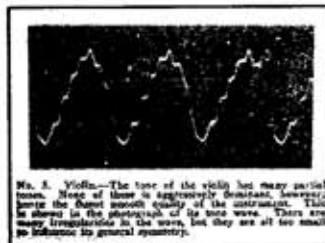
### Scene 19: The Panic of 1907



175

3 Muses with Lute

*POLONAISE,*  
Op. 8,  
by  
Ludwig van  
Beethoven.



176

Violin Oscillograph

By the Fall of 1907, it had become obvious to Oscar T. Crosby that the Telharmonium would never eliminate traditional instruments and



177  
Gamblers at Roulette,  
Monte Carlo

the salaries of those who played them. Rather than throw any more money or time at this white elephant of music, he decided to take his losses,



178  
Receiver and Horn  
in Hydrangea Bush

and abandoned the Telharmonium.

MUSIC up.



179  
Fear

Meanwhile, economic troubles were beginning to fester nationwide. Stock prices fell when the rigid money supply



180  
Man on Grain Bags

didn't grow with the roaring economy. Soon commodity prices collapsed. In October, the Knickerbocker



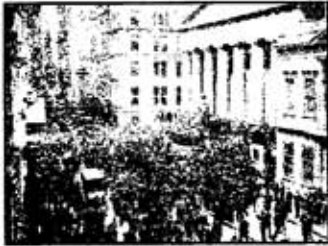
181  
Knickerbocker Trust Co.

Trust Company failed when it was discovered that its directors were loaning the bank's money to themselves. Other



182  
Teddy Roosevelt  
Grasps Credit Pillars

banks tumbled in rapid succession, and the panic of 1907



183  
Panic in Wall St.,  
October 23, 1907

was on.

SFX: angry crowd.

The stock market lost most of



184  
Man Swamped in Ticker Tape

its value, and currency was being sold at a premium. Businesses went bankrupt



185  
Maelstrom of  
Stock Gambling

and 80% of the Broadway shows closed.

During the panic, Crosby's junior partner, Frederick C. Todd, took the helm of the New York Electric Music Company. While depositors



186  
The Great White Way at Night

were withdrawing their money from banks, he formed a new corporation to lure fresh investors, and

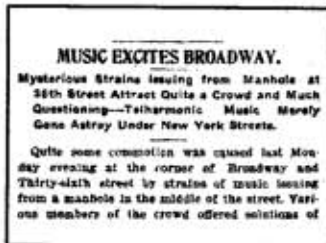


187

Woman with Japanese Lanterns

prepared to supply electrical music along Broadway once again.

**Scene 20: A Manhole Spouts Electrical Music in Broadway**



188

Magazine Article

Todd got front-page publicity with a clever publicity stunt —electrical music spouting from a manhole during rush hour in the intersection of Broadway and 25th

*KISS ME GOOD-BYE AND GO, JACK*  
by  
Ben M. Jerome.  
SFX: antique auto traffic.



189

Broadway Looking North Towards 26th St.

Street. While musicians were practicing at Telharmonic Hall, large crowds gathered to throw coins in the manhole, and the police had to shoo people away.



190

2 Performers at Keyboard



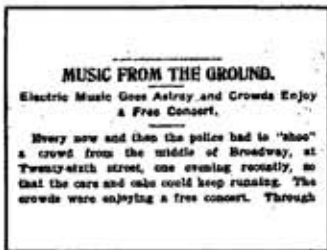
191

Fifth Ave. at Rush Hour

SFX: antique auto horns, whistles.

The company





192  
Magazine Article

later claimed that Telharmonic electricians at quitting time had “accidentally” left a receiver attached to the



193  
Broadway and 25th St. at Night

Broadway cable. Long into the night, heavenly electrical music flowed out of the street.

*“The notes are clear and vibrant.”*

*“Absolute faithfulness.”*

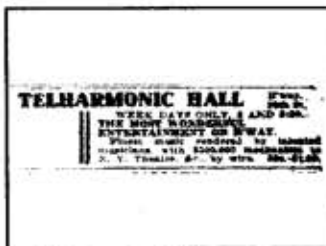
**Scene 21: Freak Shows at Telharmonic Hall**



194  
Sheet Music Cover

By this time, the Telharmonium had lost its novelty. To expand the audience, programs became increasingly light and frothy, featuring marches and show tunes. In a

*IT'S NICE TO HAVE A SWEETHEART*  
from  
*THE TOURISTS*  
by  
Gustave Kerker



195  
Display Advertisement



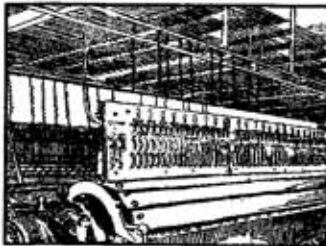
196  
4 Performers at 4 Keyboards

desperate move to stimulate interest, Telharmonic Hall had become the host of a low-grade musical freak show. Melodies were sent from new keyboards into



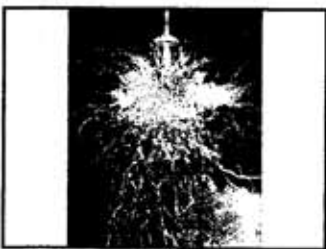
197  
Display Advertisement

lily pads and doorknobs. A soundboard was put under a man's coat to represent the "musical human body." Another stunt involved



198  
Dynamos with Coiled Wires

wiring people directly.



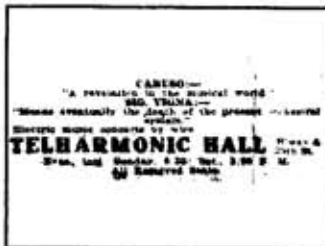
199  
Tesla Electrical Discharge

(PAUSE)  
Noses tingled and fingers vibrated as several thousand volts ran through their systems.

SFX: high-voltage buzzes, arcing, sparks.

(PAUSE)  
The press called it the "Liver Gavotte."

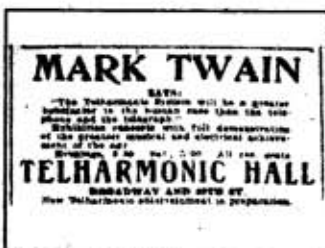
SFX up.



200  
Display Advertisement

(PAUSE)  
Ironically, as classical music disappeared from Telharmonic Hall, Todd managed to wangle testimonials from stars at the Metropolitan Opera.

SFX: zap!



201  
Display Advertisement

Next he touted a literary endorsement. And



202

Johanna Gadski

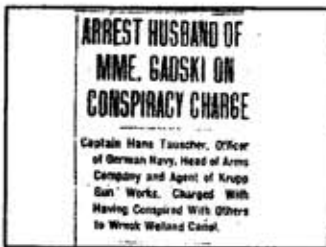
finally, one from Johanna Gadski, a German soprano whose career



203

Display Advertisement

would later flounder after her husband, a German Naval officer, tried to blow up the Welland Canal



204

Newspaper Headline

in Canada during World War I.

### Scene 22: *Telharmonic Hall Closes*



205

Big Stick Hits Stock Exchange

Unfortunately,

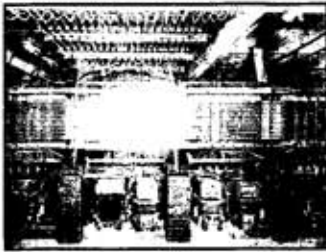
*INTERMEZZO*  
from  
*CAVALLERIA RUSTICANA*  
by  
Pietro Mascagni.



206

Sunday Newspaper Feature Story

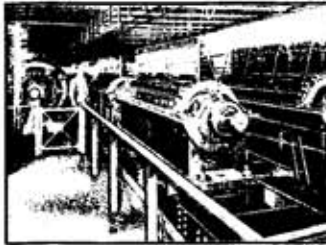
business did not pick up and capital could no longer be squeezed out of investors. The expenses of



207

Overhead Wires, Transformers

operating the central station, paying for the franchise, and wiring the city had been staggering. With less than

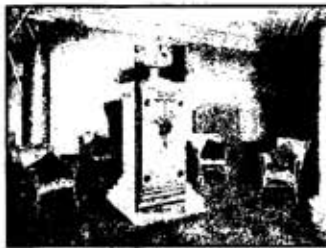


208

Workman with Dynamos

two miles of wires having been placed in the streets, there was virtually no income.

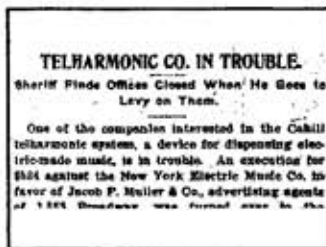
Telharmonic Hall gave its



209

Telharmonic Hall,  
Urn on Pedestal

last concert in February 1908. Frederick C. Todd closed the doors and



210

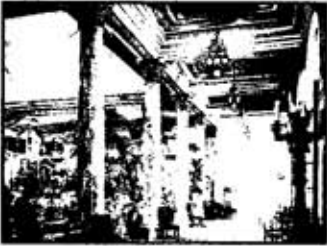
Magazine Article

disappeared. In May, an unpaid advertising bill was turned over for collection to the sheriff. A deputy visited Telharmonic



211  
Plaza Hotel

Hall in June to find it deserted. From the Plaza Hotel, which had just opened a few months earlier, came another lawsuit. The builders had wired every room for Telharmonic service. Now the New York Electric Music Company was



212  
Main Corridor, Palm Room



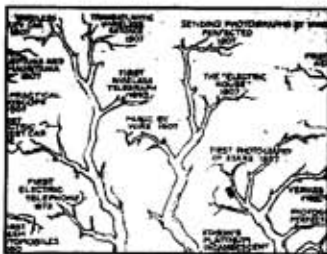
213  
Drawing Room and Dining Room, State Apartments



214  
Ball and Banqueting Room



215  
Mantels in State Apartments



216

Branches on Tree of Science

unable to fulfill its contract. It seemed that the newest branch on the tree of science had become gnarled and twisted, and would be left to

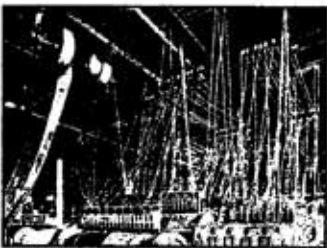


217

Tree of Science

wither away.

**Scene 23: Thaddeus Cahill and the Third Telharmonium**



218

Drive Belt, New Dynamos

*SERENADE*  
by  
Thomas Thompson.

Thaddeus Cahill refused to accept defeat. He was still hard at work in Holyoke, and was



219

Aerial View of Holyoke



220

Switchboard Erection

valiantly starting to build the third Telharmonium.

SFX: machinery, hammering.

(PAUSE)  
Cahill

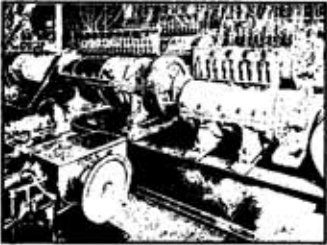
SFX up.



221

Times Square, Looking South from 45th St.

resolved to get a franchise from New York City to operate the Telharmonium himself. He completed the new instrument



222

Third Telharmonium, Dynamos

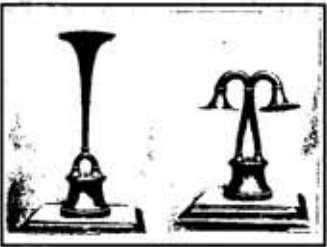
two years later, in April of 1910. Like the second machine, it weighed 200 tons.



223

2 Performers at New Keyboard

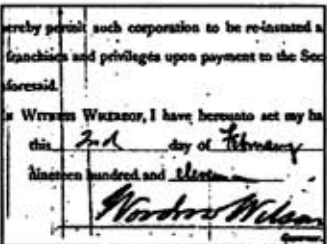
This time, music was produced on standard keyboards and there was just intonation in a few keys.



224

Ornamental Tone Outlets

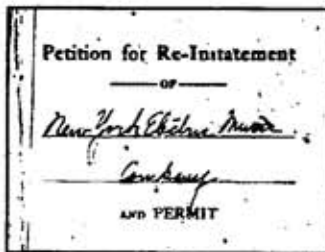
By 1911, Cahill gained control of the corporations set up by Crosby and Todd. For one hundred and seventy-



225

Woodrow Wilson's Signature

five dollars, New Jersey's Governor Woodrow Wilson approved the reinstatement of the New York Electric Music



226  
Petition for Re-Instatement

Company, formally a New Jersey corporation.

**Scene 24: The Last New York Debut**



227  
Contract

After much delay, Cahill finally negotiated a franchise with New York

*I LOVE YOU SO*  
*(THE MERRY WIDOW WALTZ)*  
by  
Franz Lehár.



228  
Fashionable People  
near Madison Square

City. New Yorkers would soon have their beloved electrical music back. Cahill and his brothers immediately transported the third



229  
Central Station on West 56th St.

Telharmonium. The new central station was housed in a shabby little building on West 56th Street.



230  
Cable Map, 1913

The Cahills ran a cable to Columbus Circle and Carnegie Hall, and then down Broadway.

In February 1912,

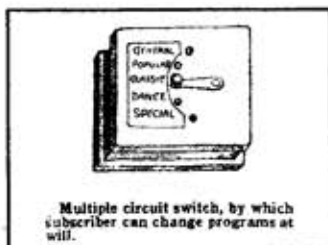




231  
Carnegie Hall



232  
The Chapter Room,  
Carnegie Hall



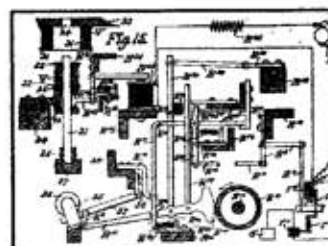
Multiple circuit switch, by which  
subscriber can change programs at  
will.

233  
Multiple Circuit Switch



Receiver and horn in small floral  
vase for a beautiful ornament.

234  
Receiver and Horn in Floral Vase



235  
Caption: Key Mechanism

the final debut of a Telharmonium took place in the Chapter Room of Carnegie Hall, a small concert room on the fifth floor. Neither the press nor the public was especially interested in the revival of a six-year-old failure.

*“There are still many improvements to be made in the tone and carrying power of the Telharmonium.”*

*“The absence of*

*brilliancy, mordancy, incisiveness, makes the Telharmonium but a sorry substitute for an orchestra—even a small*

*one.”*

*“Rather crude and the operation not as rapid as an organ.”*

**Scene 25: Experimental Transmissions, No Investors, No Subscribers**



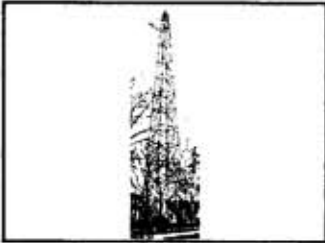
236

"Bank of Good Fortune" Check



237

Telephone Receiver with Horn



238

Radio Transmission Antenna



239

Pabst Grand Circle Hotel



240

Hotel Astor

Later that year, Thaddeus Cahill convinced the city to reduce the franchise fee. But no one was willing to invest money in the enterprise, and this time there would be no

*TO THE EVENING STAR*  
from  
*TANNHÄUSER*  
by  
Richard Wagner.

subscribers. The orchestral sound of his third Telharmonium still left much to be desired, and everyone was eagerly anticipating commercial radio.

Only several temporary and trial Telharmonium outlets were

installed. One was in the Pabst Grand Circle Hotel on Columbus Circle. Another was at the magnificent

Hotel Astor near Times Square. For the Astor program, which featured 16 numbers, the Cahill brothers

SYNOPSIS	
1. The Name	.....
2. The Name	.....
3. The Name	.....
4. The Name	.....
5. The Name	.....
6. The Name	.....
7. The Name	.....
8. The Name	.....
9. The Name	.....
10. The Name	.....
11. The Name	.....
12. The Name	.....
13. The Name	.....
14. The Name	.....
15. The Name	.....
16. The Name	.....
17. The Name	.....
18. The Name	.....
19. The Name	.....
20. The Name	.....

241  
Program

changed the name of the instrument to the Electrophone, but to no avail.

(PAUSE)

MUSIC up.

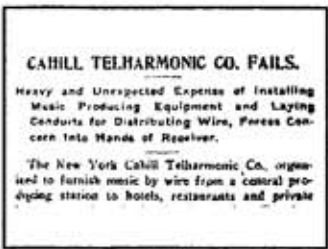
*“As a matter of fact, only the usual organ tones are perceptible to the musically informed.”*

**Scene 26: Epilogue**



242  
Newspaper Headline

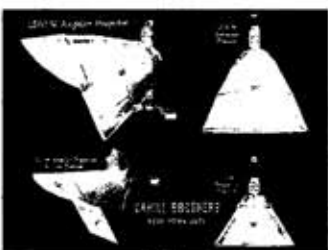
Just before Christmas, 1914, with a debt of



243  
Magazine Article

\$145,000, the Cahill brothers' corporation finally declared bankruptcy.

The



244  
Cahill Brothers Floodlights

family fortunes improved several years later when brother George invented the Cahill glareless duplex arc floodlight projector, which made night sporting events possible for the first time.

**THADDEUS CAHILL,  
INVENTOR, 66, DIES**  
Beginning as a Lawyer, He  
Turned to Electrical and  
Scientific Study.

245  
Newspaper Headline

Thaddeus Cahill died of a heart attack in 1934.

Two years later, a clock maker named Laurens Hammond introduced a miniaturized Telharmonium he called the Hammond



CREATES LOVELY TONES  
— ELECTRICALLY  
246  
Hammond Organ

Organ. His patented rotating tone wheels were extremely similar to Thaddeus

*TELHARMANIA*  
by  
Reynold Weidenaar.



IN A FOUR FOOT SQUARE  
247  
Performer at Hammond Organ

Cahill's patented rotating dynamos. However, by then three



248  
Mother and Children  
at Hammond Organ

of the Cahill brothers and sisters had died, and the elderly survivors were too old to undertake a patent lawsuit.

Although the second and third Telharmoniums had been



249  
Arthur T. Cahill, 1906

scrapped when taken out of service, brother Arthur devotedly preserved the first one in New Jersey for almost



250

Arthur T. Cahill, Late 1950's

50 years. He circulated a letter in Nineteen-fifty-

MUSIC out.

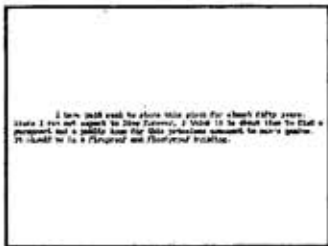


251

Letter from Arthur T. Cahill

one: *The five great and immortal patents of my late*

*MAPLE LEAF RAG*  
by  
Scott Joplin.



252

Letter from Arthur T. Cahill

*brother, Dr. Thaddeus Cahill, reveal everything that has been done, or that can ever be done, in electrical music."*

There was no interest.



253

Caption:

RCA Synthesizer, 1958

In 1959 he wrote David Sarnoff, the head of RCA, and offered to help build and install a new Telharmonium as an improvement over the RCA Synthesizer. RCA politely declined. Upon Arthur's death in Nineteen-



254

Performer at Telharmonium,  
Holyoke, 1906

sixty-two, the last remaining Telharmonium was sold for scrap.

Yet, Thaddeus Cahill's revolutionary idea of electrical music did prevail. Over



255

Caption:  
Moog Synthesizer, 1965

the years, many inventors took up the challenge. By Nineteen-eighty-



256

Caption: Robert A. Moog, 1972

five, more electronic keyboard instruments were being sold than any other



257

Caption:  
Kurzweil Midiboard, 1986

musical instrument.

One company, Kurzweil Music Systems, happened to



258

Maryland Club

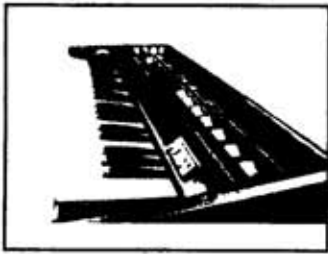
give a fundraising presentation at the Maryland Club, just where the Telharmonium was first demonstrated in 1900. Unfortunately, Kurzweil followed the steps of the New York Electric Music Company into bankruptcy.



259

Caption:  
PolyMoog Synthesizer, 1974

Nevertheless, most film and TV soundtracks today use electronically



260

PolyMoog Synthesizer, 1976

generated music. Thaddeus Cahill's extraordinary



261

Thaddeus Cahill

vision laid the foundation stones, changing forever the music we listen to.

**Scene 27: Screen Credits**

**Magic Music  
from the  
Telharmonium**

*AULD LANG SYNE*  
Scottish Folk Song.

**Written, Produced,  
and Directed by  
Reynold Weidenaar**

**Narrated by  
Brian Lehrer**

**Keyboard Performances by  
Barbara Blegen**

**With the Support of**  
The National Academy of  
Recording Arts and Sciences  
The Center for  
Electronic Music  
Harvestworks, Inc. /  
Studio PASS  
William Paterson University

**Online Editors**  
**Nils Nichols**  
**Topher Dune**

Through the Standby  
Program at Unitel Post 38

**Picture Sources**

AT&T Corporate Archives  
AT&T Bell Laboratories  
Carnegie Hall Archives  
David Sarnoff  
Research Center  
Ella Merkel DiCarlo

*“It was like invisible  
hands at the close of  
summer day*

Holyoke Public Library  
The Maryland Club  
Robert A. Moog  
Museum of the  
City of New York  
New Jersey Secretary of State  
New York City Board of  
Estimate and Apportionment

*striking from unseen harp  
strings unspeakable mu-  
sic, to comfort, to solace,*

New York City  
Municipal Archives  
The New York  
Historical Society  
The New York Public Library  
Office for Metropolitan History  
Thomas L. Rhea  
Margaret Cahill Schwartz

*and to cheer.”*



**BLACK**

*“Subtle and entrancing  
beyond any harmony yet  
heard.”*

**Copyright © 1998  
Magnetic Music  
Publishing Co. (ASCAP)**

**BLACK**

**MUSIC out.**

**Absolutely perfect music.**

*“Absolutely perfect  
music.”*

**For Joyce**

## **Bibliography**

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= Number, City: Publisher (Printer), Page Number, **Source/Archive/Repository**.

Abbreviations used in page-number field: c = cover, fp = facing page, fr = frontispiece, mag  
= magazine section, p = page, pt = part, s = sheet.

### **Scene 1**

#### 001 Ballroom Dancers

Color, 1907, postcard, The Galop, "Masque" Series No. 99, #994, New York: Julius Bien & Co., **RW**.

#### 002 Title

B&W, 1906 Dec 16, *New York Times*, pt 3, p 3.

#### 003 Dynamo Cross-Section

B&W, 1903 Feb 17, *British Patent 3666A*, s 11.

#### 004 Telephone Receiver and Horn

B&W, 1906 Mar 17, Lazarnick, *Musical Age*, p 597.

#### 005 Cross-Sections and Side Elevation of Dynamos

B&W, 1903 Feb 17, *British Patent 3666A*, s 9.

#### 006 Top and Side of Dynamo Assembly

B&W, 1906 Aug 25, Lazarnick, *Musical America*, p 17.

#### 007 Top Rear of Dynamo Assembly

B&W, 1906 Jul, *McClure's Magazine*, p 292.

#### 008 "Largo" Sheet Music

B&W, George Frideric Handel, *Xerxes*

#### 009 Dynamo Assembly, Bare Bulb Hanging Overhead

B&W, 1906 Jul, *McClure's Magazine*, p 292.

#### 010 End Rotor and Shaft

B&W, 1906 Jul, *McClure's Magazine*, p 292.

#### 011 Outlets for Wired Music

B&W, 1906 Apr?, stock prospectus, Oscar T. Crosby, New York: *New York Electric Music Company*, p 8, **RW**.

#### 012 Dynamo Teeth

B&W, 1903 Feb 17, *British Patent 3666A*, s 12.

#### 013 Broadside

B&W, 1906 Dec?, Ray Stannard Baker, *The Wonderful Telharmonic System*, New York: New York Electric Music Company, **RW**.

#### 014 End View of Dynamo

B&W, 1907 Mar 9, Charles Figaro, *Scientific American*, p 205, **RW**.

#### 015 Pamphlet

B&W, 1907 Jan?, *Telharmony: A New Art*, New York: New York Electric Music Company, p 1, **RW**.

#### 016 Dynamo Wiring: Field and Armature Windings

B&W, 1906 Oct 27, *American Telephone Journal*, p 269.

017 Four Men Toasting at Fireplace  
B&W, 1912 Feb 10, *Illustrated London News*, p 223.

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018 Dr. Thaddeus Cahill, 1892  
B&W, 1906 May, Rice, *Success*.

019 Cahill One-Hand Electric Typewriter with Piano-Style Keyboard  
B&W, photo with pasted typescript, 1896, **MCS**.

020 Trumpeter Plays into Telephone  
B&W, 1906 Nov 3, *American Telephone Journal*, p 285.

021 Rotors  
B&W, 1897 Aug 21, *British Patent 8725*, s 4.

022 Waveforms of Harmonics: Effect of Upper Partial  
B&W, 1907 Mar 9, *Scientific American*, p 210.

023 Side View of Mainframe  
B&W, 1897 Apr 6, *U. S. Patent 580,035*, s 2.

024 Pulley, Drive Belts, Pitch Shafts  
B&W, 1897 Apr 6, *U. S. Patent 580,035*, s 3.

025 Telephone Receiver and Horn Suspended in Trees above Outdoor Café  
B&W, 1906 Nov 3, *American Telephone Journal*, p 285.

026 Winged Lyre  
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027 George Westinghouse with Lord Kelvin  
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028 Lord Kelvin  
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032 Top of Dynamo Assembly  
B&W, 1906 Jul, *McClure's Magazine*, p 292.

033 Overhead View of 12 Pitch Shafts  
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036 Map of Holyoke Canals

Color, 1884, *Atlas of Holyoke City, Massachusetts*, Boston: George H. Walker & Co., **HPL**.

037 Holyoke Skyline at Night

Color, postcard, *Skyline of Holyoke, from Buckley Blvd., at Night, Holyoke, Mass.*, #71671, Springfield News Co. (Boston: Tichnor Bros. Inc.), **EMD**.

038 Mills on the Second-Level Canal

Color, 1916 Feb 7 postmark, postcard, *Second Level Canal, Holyoke, Mass.*, New York: A. C. Besselman & Co. (printed in Germany), **EMD**.

039 George Frederick Cahill

B&W, 1906 Mar 18, Van Norman, *Boston Post*, p 29.

040 Arthur Timothy Cahill

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041 Edwin Hall Pierce

B&W, 1898?, Edwin Hall Pierce, *Edwin H. Pierce, Teacher of Piano, Violin, Harmony and Composition, Also Sight-reading for Singers*, Auburn, N.Y., p 1, **RW**.

042 Edwin Hall Pierce at the Telharmonium, Holyoke

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B&W, 1974 May 15, *Smithfield Times*, p 5.

046 Oboe Oscillograph

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047 Young Mill Worker with Dynamo Rotor

B&W, 1906 Jul, *McClure's Magazine*, p 293.

### Scene 5

048 Workman with Dynamos

B&W, 1936 Nov, *Proceedings of the Institute of Radio Engineers*, p 1443.

049 Switchboards

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050 Thaddeus Cahill in His Office, Water Power Building, Holyoke

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Color, 1915 Nov 2 postmark, postcard, *Dwight Street and Hotel Hamilton, Holyoke, Mass.*, #M-4840, Springfield News Co. (New York: Americhrome), **EMD**.

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054 Woman with Cigarette  
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057 Newspaper Story  
B&W, 1906 Mar 18, *Boston Post*, p 29.

058 Switchboard  
B&W, 1906 Dec?, *Telharmony*, New York: New York Electric Music Company, p 6, **RW**.

059 Two Performers at Keyboard  
B&W, 1906 Jul, *McClure's Magazine*, p 294.

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060 New York City Skyline  
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061 Aerial View of New York and Surroundings  
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062 Times Tower, Broadway Building, Broadway Looking North from 39th Street  
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067 People Leaving the Metropolitan Opera House at Night  
B&W, photo, *Scrapbook of New York City Views, Reel 15*, **NYPL**.

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068 Telharmonium Console with Sign  
B&W, 1907 Jun, *Gunter's Magazine*, p 563.

069 Dynamos, Pole  
B&W, 1936 Nov, *Proceedings of the Institute of Radio Engineers*, p 1443.

070 Two Performers at Keyboard  
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071 Timbre-Control Switches, Keyboard, Pedalboard  
B&W, 1903 Feb 17, *British Patent 3666A*, s 14.

072 Performer with Timbre-Control Switches  
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B&W, 1907 Jul 13, D. A. G., *Deseret Evening News*, p 21.

081 Console with Telephone  
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082 New York Riverfront at Night  
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086 Big Transformer  
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Magic Music from the Telharmonium



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American Telephone and Telegraph Co. Corporate Archives, 195 Broadway, 5th Floor, New York, NY 10007.

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Board of Estimate and Apportionment, Bureau of Franchises, Room 1037, Municipal Building, New York, NY 10007.

#### **BELL**

AT&T Bell Laboratories, 5 Reinman Rd., Warren, NJ 07060.

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#### **MACNY**

Municipal Archives, The City of New York, Department of Records and Information Services, 31 Chambers St., Suite 103, New York, NY 10007.



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- MCNY** Museum of the City of New York, 1220 Fifth Ave., New York, NY 10029.
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- OMH** Office for Metropolitan History, 246 W. 80th St., 3rd Floor, Room 8, New York, NY 10024.
- TLM** Thomas L. Rhea, P.O. Box 3306, Fayville, MA 01745.
- RAM** Robert A. Moog, 554C Riverside Dr., Asheville, NC 28801.
- RW** Reynold Weidenaar, 155 W. 68th St., Apt. 22D, New York, NY 10023.