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WALTER GUYTON CADY PAPERS, 1903-1974

(CUBIC FEET: 22.5; 51 DB; 1 Flt B; 21 ShB)

by: James A. Steed, June 1975; revised Alison Oswald, March 2004

Biography

Walter Guyton Cady (1874-1973) was born in Providence, Rhode Island. He graduated from Brown University (Bachelors 1895 and Masters 1897) and from the University of Berlin (Ph. D. Physics, 1900). Cady worked at a magnetic observatory of the U.S. Coast and Geodetic Survey from 1900-1902. In 1902, Cady joined the faculty of Wesleyan University as a professor of physics where he remained until 1946. During WW I, Cady used piezoelectricity—electricity or electric polarity due to pressure especially in a crystalline substance as quartz—and underwater sound to make devices that would locate enemy submarines. From this work evolved the crystal resonator and oscillator. Piezoelectricity is utilized in microphones, phonograph pickups, and telephone communications systems.

During World War II, Cady worked on military applications of piezoelectricity. Among the applications were supersonic trainers for radar operators, which employed piezoelectric transducers in liquid tanks to generate realistic echoes on radar indicators. In 1946, Cady published a book titled *Piezoelectricity An Introduction To The Theory And Applications Of Electromechanical Phenomena In Crystals*, 1946. After his retirement in 1951 to Pasadena, California, Cady returned to Providence, Rhode Island in 1963 and was active in consulting work for industry and the Federal government. Cady was an active member of Institute of Radio Engineers (IRE), becoming a fellow of the institute in 1927 and receiving the Morris N. Liebmann Memorial Award in 1928. He also received the Dudell Medal from the Physics Society of Great Britain in 1936. Cady also served as an editor for the *PROCEEDINGS OF IRE* and as president of IRE, was Editor of the *Physical Review* from 1924-1926, a member of the national Research Committee, 1935-1938, and a fellow of the American Academy of Arts and Sciences. Cady's principal interests included the study of electrical discharges in gases, detection of wireless waves, piezoelectricity, ultrasonics, piezoelectric resonators and oscillators, and crystal devices.

Cady married Kathrin Olive Miller (1883-1909) and they had one son, Willoughby Miller Cady (1907-1953), also a physicist.

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Scope and Content

The papers consist chiefly of Cady's research notebooks on various subjects in physics, specifically piezoelectricity, a considerable technical reprint file and records of Cady's consultant work, patents, books, and card file indexes. The bulk of the collection dates from the early 1900s to the 1950s.

The collection is arranged into eleven (11) series: Series 1: Research Notebooks, 1896-1972; Series 2: Chapter Drafts for *Piezoelectricity An Introduction To The Theory And Applications Of Electromechanical Phenomena In Crystals*, 1945; Series 3: Technical Reprint Files, 1900s-1960s; Series 4: Walter G. Cady's Writings and Reviews, 1950s-1960s; Series 5: Consultant Work, 1931-1967; Series 6: Institute of Radio Engineers (IRE), 1945-1963; Series 7: Institute of Electric and Electronics Engineers (IEEE), 1932-1973; Series 8: Patent Records, 1914-1974; Series 9: Books, 1887-1960; and Series 10: Miscellaneous, 1949-1973; and Series 11: Card Indexes, 1940s-1960s.

Series 1: Research Notebooks, 1896-1972

The notebooks are arranged according to Cady's original groupings. Cady labeled each notebook using an alpha-numeric system. In some instances, a date range and a brief listing of the subjects/topics covered in the notebook are provided in the container list. The groupings have been further sub-divided into four series:

Subseries A: Alphabetical Notebooks, 1919-1972

Subseries B: Numeric Notebooks, 1903-1948

Subseries C: Record Books (#1-#43), 1896-1946

Subseries D: Miscellaneous Notebooks, 1917-1963

Series 2: Chapter Drafts For *Piezoelectricity An Introduction To The Theory And Applications Of Electromechanical Phenomena In Crystals*, 1945

Series includes drafts of chapters (#1-#31), one appendix and indices for Cady's book *Piezoelectricity An Introduction To The Theory And Applications Of Electromechanical Phenomena In Crystals*, published in 1946.

Series 3: Technical Reprint Files, 1900s-1960s

Arranged alphabetically by the author's surname, these files contain reprints of articles dealing with piezoelectricity and other aspects of physics that informed Cady's work. In some instances, Cady has annotated the articles. Most articles are in English, but some are in Czech, French,

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German, Japanese, Italian, and Russian.

Series 4: Walter G. Cady's Writings and Reviews, 1950s-1960s

This series consists of one folder of material containing some articles and reviews authored by Cady. Also included is a bibliography compiled by Cady for articles or books in the field of physics and some biographical notes.

Series 5: Consultant Work, 1931-1967

Arranged alphabetically by client name, this series consists of organizations and federal agencies that Cady did consulting/contract work for. The documentation contains correspondence, contracts and technical status reports.

Series 6: Institute of Radio Engineers (IRE), 1945-1963

As a member of IRE, Cady was active within the organization on various committees and assisted with reviews and creating and editing standards issued by IRE. The materials contain by-laws, definitions, committee minutes, correspondence, and published copies of standards. Many of the materials contain Cady's annotations.

Series 7: Institute of Electric and Electronics Engineers (IEEE), 1932-1973

This series contains committee minutes, correspondence, and standards issued by IEEE.

Series 8: Patent Records, 1914-1974

The patent records consist of letter patents issued to Cady and copies from the United States, Canada, and the United Kingdom, patent applications, specifications, notes, and invention disclosure statements from the Office of Naval Research. Cady worked with the Office of Naval Research while at the Scott Laboratory, Wesleyan University during the 1940s and 1950s.

Series 9: Books, 1887-1960s

This series includes five books on the subject of piezoelectricity. The books are in Czech, French, and German.

Series 10: Miscellaneous, 1949-1973

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This series contains miscellaneous items such as notes, print materials, product literature, and correspondence.

Series 11: Card Indexes, 1940s-1960s

The card indexes are arranged alphabetically and index topics, abstracts, and notes. The index cards were created by Cady when organizing his research notebooks.

Container List

<u>Box</u>	<u>Folder</u>	
		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		<u>Subseries A: Alphabetic Notebooks, 1919-1972</u>
1	1	Notebook AV Abstracts from various authors, arranged alphabetically with comments by Cady.
	2	Notebook AD Abstracts from various authors, arranged alphabetically with comments by Cady.
	3	Notebook A Abstracts from various authors, arranged alphabetically with comments by Cady.
	4	Notebooks AM Abstracts from various authors, arranged alphabetically with comments by Cady.
	5	Notebook AMAS Abstracts from various authors, arranged alphabetically with comments by Cady.
	6	Notebook AC Abstracts from various authors, arranged alphabetically with comments by Cady.
	7	Notebook AK Abstracts from various authors, arranged alphabetically with comments by Cady.
2	1	Notebook AR Abstracts from various authors, arranged alphabetically with comments by Cady.
	2	Notebook AV Abstracts from various authors, arranged alphabetically with comments by Cady.
	3	Notebook B, 1935-1962 Resonator theory, vibrating rods and circle diagram.
	4	Notebook C, 1920-1934

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		Resonance circle, current limiting device (crystal filter), and methods for determining resonator constants.
	5	Notebook D, 1935 Resonator theory, short electrodes, equivalent stiffness, and harmonics
	6	Notebook E, 1935-1937 Rotated cuts, transformation of axes, air gap, resonator theory, graphical methods and notes on Giebe and Scheibe.
3	1	Notebook F, 1936-1938 Rochelle salt theory, Mueller's work, L-cut, comments on Currie book, and thermodynamic equations
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		Subseries A: Alphabetic Notebooks, 1919-1972
3	2	Notebook H, 1920-1921 Quartz steel resonator theory
	3	Notebook J, 1930-1956 Hypothetical devices, thermo-electric vibrator, photo-cell to control vibrations, energy produced by a rotating dielectric, television by totally reflecting prism, optical transmission line, reading device for the blind, ultrasonic images, ultrasonic echo, and river dredging.
	4	Notebook K, 1937-1940 Rochelle salt classic constants, aluminum octant, L-cut, Strabel contour.
	5	Notebook CB, 1948-1949 Rochelle salt classic constants, aluminum octant, L-cut, Strabel contour.
	6	Notebook CQ, 1952-1956 Rochelle salt classic constants, aluminum octant, L-cut, Strabel contour.
	7	Notebook L, 1938-1940 Graphical methods, crystallography, Rochelle salt resonator and theory, polarization theory, thermodynamics, notes on Giebe, Scheibe And Koga, and the history of amber.
	8	Notebook M, 1928-1934 Resonator theory, flexure, resonance circle, inversion, stabilization, and tourmaline.
4	1	Notebook N, 1921-1930 Beginning of resonator theory for rod, circle diagram, air gaps, flexural vibrations, equivalent constants, shear vibrations, and quartz cuts.
	2	Notebook S, 1927-1936 Shear and flexural vibrations, Y-cut resonator, rotated y-cut.
	3	Notebook T, 1929-1937 Resonator theory, crevasse method, resonance circle, space charge, gap effect, and polarization.
	4	Notebook U, 1919-1948

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		Tartaric acid, Rochelle salt, metallic crystals, acoustic reflection and pressure.
	5	Notebook V, 1938-1940 Rochelle salt, ferromagnetism, magnetostriction, piezomagnetism, pyroelectricity, electro and piezo-optics.
	6	Notebook W, 1940-1941 Christoffel theory, ellipsoids of elast, flexure, torsion, Rochelle salt resonator and theory, and quartz vibrations.
	7	Notebook X, 1917-1919 Earliest piezoelectric observations in Schenectady, primitive transducers of quartz and Rochelle salt, toggle receiver, submarine detection, and first attempt at piezo-oscillator.
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		<u>Subseries A: Alphabetic Notebooks, 1919-1972</u>
5	1	Notebook Y, 1941-1943 Resonator theory, graphical methods, tensorial pyroelectricity, vibrations with gap, electrostriction, electrets, stereographic projection, and transducers.
	2	Notebook Z, 1943-1944 Elastic constants, rotated axes, resonator theory, graphical methods, etch figures, and accelerometer.
	3	Notebook BA, 1945-1946 Polarization, charge, and displacement theories of Rochelle salt, space charge, transducer theory, beginning of piezoelectric receiver theory and PN and L-cut crystals.
	4	Notebook BC, 1945 Notes on ultrasonics, streaming acoustic energy, mostly in connection with the Radiation Laboratory contract.
	5	Notebook BD, 1947-1955 Radiation Laboratory Report, corrections correspondence, radiometer and receiver theory.
6	1	Notebook BF, 1945-1946 Voigt theory, transducer and resonator theories
	2	Notebook BG, 1945-1950 Thickness vibrations in ADP, capacitance bridge, transducer theory, receiving transducer, and graphical methods.
	3	Notebook BH, 1945 Acoustic streaming and acoustic radiometer.
	4	Notebook BJ, 1946-1950 Energy equations, and space charge theory.

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	5	Notebook BL, 1945-1946 Dietz's notes on ultrasonics.
	6	Notebook CK, 1950-1951 Cavity radiometer.
7	1	Notebook BE, 1948-1949 Instrumental data.
	2	Notebook BM, 1946 Ordwes and color filters.
	3	Notebook BR, 1940-1945 Notes from Brush Company.
	4	Notebook WV, 1939 Notes on Wooster and Voigt.
	5	Notebook BN, 1949-1952 Transducers, cavity radiometer, capacitance bridge, and space charge.
	6	Notebook BP, 1947-1950 Notes on Wesleyan ONR reports.
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		<u>Subseries A: Alphabetic Notebooks, 1919-1972</u>
7	7	Notebook BQ, 1947-1948 Goodman's notes.
	8	Notebook BS, 1947-1948 Condenser radiometer, lengthwise vibration theory, optical methods in ultrasonics, transducer and resonator theory.
8	1	Notebook BT, 1945-1956 Log of visits received, applicants for assistantships, and ONR business.
	2	Notebook BU, 1947-1952 ADP transducer and L-cut.
	3	Notebook BW, 1948-1949 Transducer equations, composite resonator, and space charge.
	4	Notebook BY, 1948-1949 Cavity radiometer and power measurement.
	5	Notebook CA, 1961-1968 Cady's personal notes on cricket chirps, mirages, micro-photography and record of color slides.
	6	Notebook CC, 1949-1950 Capacitance bridge and circle diagram.
9	1	Notebook CE, 1951-1963 Crystal equivalent network, ultrasonic reflection, and tractrix.
	2	Notebook CH, 1950 Acoustic absorption and Borgnis notes.
	3	Notebook CL, 1950

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		Transducers as receivers and space charge.
	4	Notebook CM, 1951-1953 (see also Notebook AV) Transducer and resonator theory, project of generating acoustic waves at frequency 3000 megacycles.
	5	Notebook CO, 1950-1954 Variable frequency interferometer, transducers, 3000 megacycles, crystals as receivers and acoustic radiometer.
	6	Notebook CP, 1951-1952 15 megacycle transducers, resonance circle, and 15 megacycle thickness resonators.
10	1	Notebook CR, 1951-1953 Measurement of acoustic intensity
	2	Notebook CS, 1955 3000 megacycle.
	3	Notebook DA, 1950-1960 Beginning of work at 3000 megacycles and composite resonator.
	4	Notebook DD, 1954 Transducer as receiver and acoustic filter.
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		<u>Subseries A: Alphabetic Notebooks, 1919-1972</u>
10	5	Notebook DC, 1953-1954 3000 megacycle, composite resonator, and capacitance bridge.
	6	Notebook DE, 1953-1958 Electrets, monolayers and 3000 megacycle.
	7	Notebook DG, 1955 3000 megacycle and acoustic filters.
	8	Notebook DH, 1954 Acoustic filters.
11	1	Notebook DJ, 1955-1956 Double piezoelectric resonator, thickness transducer, and plate with detuned backing.
	2	Notebook DN, 1955-1959 Work for Mullenbach on electrostriction.
	3	Notebook DP, 1956-1958 Work for Mullenbach and electrostriction theory.
	4	Notebook DS, 1959-1960 Electrostriction, broad-band transducer, consulting work, and rotating electric field.
	5	Notebook DR, 1959 Electrostriction and notes on consulting work.
	6	Notebook DQ, 1958

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		Electrostriction and work for Mullenbach.
12	1	Notebook DT, 1960-1961 Broad-band transducer, visible acoustic images, consulting work, two-way accelerometer and electrostriction.
	2	Notebook DU, 1951-1963 Consultant work and 2-way and other forms of accelerometer
	3	Notebook DU, 1964-1965 Consultant work and 2-way and other forms of accelerometer
	4-5	Notebook DX, 1965-1969 Tests of crystals for accelerometer, 1-way, 2-way and 3-way devices, theory, equivalent network, coupling factor, power, use of magnetostriction and capacitance, work as consultant, and manuscript for paper.
	6	Notebook DY, 1967-1970 Consulting work, rotating and oscillating electric fields, shear rules for 1-way and 2-way, DC transmission, generator and motor.
13	1	Notebook DY, 1970-1972 Consulting work, rotating and oscillating electric fields, shear rules for 1-way and 2-way, DC transmission, generator and motor.
	7	Notebook RS (A-K), [ca. 1940s?] Papers on Rochelle salt arranged according to author.
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		<u>Subseries A: Alphabetic Notebooks, 1919-1972</u>
14	1	Notebook RS (E-K), [ca. 1930s?] Papers on Rochelle salt arranged according to author.
	2	Notebook RS (L-MO), [ca. 1930s-1940s?] Papers on Rochelle salt arranged according to author.
	3	Notebook RS (MU-R), [ca. 1930s?] Papers on Rochelle salt arranged according to author.
	4	Notebook RS (S-Z), [ca. 1930s?] Papers on Rochelle salt arranged according to author.
		<u>Subseries B: Numeric Notebooks, 1903-1948</u>
17	1	Notebook 1, 1903-1904 Miscellaneous notes on apparatus at Wesleyan.
	2	Notebook 2, 1905-1909 Magnetic variometer, bolometer, glow-arc, and rotation in the electric arc.
	3	Notebook 3, 1909-1912 Glow-arc, arc rotations, and vaporizing cathode.
	4	Notebook 4, 1907-1910 Singing transformer, hertz waves, and magnetic variometer

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	5	Notebook 5, 1909-1913 Perikon and silicon detectors and signing arc.
	6	Notebook 6, 1908-1912 Electrolytic detector, coherer, astigmatism tests with CS ₂ lens, arc rotations and W and Mo arcs.
	7	Notebook 7, 1910-1912 Magnetic variometer and aluminum anode.
	8	Notebook 9, 1912-1916 Nickel arc, rotations, vaporizing cathode, signing arc and quenched spark.
	9	Notebook 10, 1912-1913 Arc rotations, vaporizing cathode, Hg and W arcs.
	10	Notebook 11, 1912-1913 Aluminum cell for radio
	11	Notebook 12, 1912-1919 Iron arc rotations, first observation of negative capacitances of Rochelle salt, and first quartz wavelength standards.
	12	Notebook 13, 1913-1916 Arc rotations and radio transmitters
18	1	Notebook 14, 1913-1914 Iron arc and aluminum cell
	2	Notebook 15, 1913 Aluminum cell
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18	3	Notebook 16, 1914 Radio and miscellaneous observations
	4	Notebook 17, 1914 Radio and miscellaneous observations
	5	Notebook 18, 1914-1917 Adion, disturbance silencer, glow arc, and submarine detection by electrolytic method
	6	Notebook 19, 1914-1915 Radio and magnetic variometer
	7	Notebook 20, 1914-1918 Test in New London, CT, transducers, Rochelle salt, and cooperation with British Association.
	8	Notebook 21, 1915-1916 Radio and miscellaneous observations
	9	Notebook 22, 1915-1937 Magnetograph, theory and formulas, series and parallel capacitances.

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	10	Notebook 23, 1917-1918 Rochelle salt, observations in tank, transducers, shear receivers, New London, CT tests.
19	1	Notebook 25, 1919-1921 First notes and tests on stabilization and resonator tests
	2	Notebook 26, 1921-1924 Early experiments at Wesleyan on crystal resonators and stabilizers. First crystal-controlled oscillator, stabilization, quartz-steel resonators, vibration o column of liquid, crystal-driven tuning fork, crystals for Bureau of Standards, key tapping, comparison with standards in Europe, 1923.
	3	Notebook 27, 1921-1927 Resonator and oscillator tests
	4	Notebook 29, 1924-1936 Resonator stabilizer oscillator, Naval Research Lab tests, demonstrations.
	5	Notebook 30, 1927-1928 Resonator, silica bar, pinwheel effect from sand.
20	1	Notebook 31, 1928-1931 Rochelle salt resonator, flexure, torsion, sand patterns, coefficients, etch figures.
	2	Notebook 32, 1929-1942 Stereoscope, Rochelle salt, L-cut discovery, Rochelle salt motor, etching tests, rodometer devised by Gerald Holton, key tapping, and quartz bilame from Gramont.
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		<u>Subseries B: Numeric Notebooks, 1903-1948</u>
20	3	Notebook 34, 1928-1937 Surface tension pivot, silver arc, Rochelle salt tests, and optically driven resonator.
	4	Notebook 35, 1931-1932 Rochelle salt tests, flexure, and torsion.
	5	Notebook 36, 1937-1943 The L-cut, optical system of rodometer, and flicker method for quartz.
21	1	Notebook 37, 1943-1945 Etch figures on Rochelle salt and electroscope wattmeter.
	2	Notebook 38, 1943 Holton's notes on the rodometer
	3	Notebook 39, 1943 Rodometer adjustment

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	4	Notebook 40, 1947-1948 Power amplifier and impedance matching
	5	Notebook 41, 1908 Glow-arc oscillators
	6	Notebook 42, 1909-1916 Magnetic declinograph
	7	Notebook 43, 1915-1917 Various ideas for production of continuous oscillations, including piezoelectric, ideas for submarine detection, and molecular switch.
	8	Notebook (unidentified), 1897
		Subseries C: Record Books, 1896-1946
13	2	Record Book 1, 1906-1909 Includes: magnetic variometer (declinograph), arc rotations, singing arc, glow arc
	3	Record Book 2, 1896-1912 Includes curve tracing top at Brown University, thesis work on cathode rays at Berlin, glow arc, vaporizing cathode, and arc rotations at Wesleyan.
	4	Record Book 3, 1912-1928 Includes: vaporizing cathode, arc rotations, quartz resonator, and Rochelle salt.
	5	Record Book 4, 1931-1943 Includes: quartz oscillator, flexural, quartz plate vibrated by polarized light, adiabatic heat of compression, and polariscope.
	6	Record Book 5, 1922-1946 Rochelle salt thread-cutter, signing arc, and miscellaneous piezoelectric tests
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		SERIES 1: RESEARCH NOTEBOOKS, 1896-1972
		Subseries D: Miscellaneous Notebooks, 1917-1963
22	1	Notebook AH, n.d. Abstracts on surface chemistry
	2	Notebook AU, n.d. Abstracts from various authors on Ultrasonics
	3	Notebook on Crystal Optics Notes for preparation of book on piezoelectricity.
	4	Notebooks MM, R and P, 1919-1940 Types of piezoelectric strain, Tourmaline, and graphical modes.
	5	Notebook MW, 1931-1936 Series and parallel resonance, anti-resonance, and graphical representation.

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	6	Notebook NE, 1948 Lectures at Navy Electronics lab on transducers.
	7	Notebook NL, 1948-1949 Lectures at Naval Ordnance Laboratory on elasticity and piezoelectricity and problems.
	8	Notebook ST, 1936 Stereoscopy, mirror device for attachment to camera.
	9	Notebook on UCLA Course #198, 1947 Notes on lecture courses given and problems given.
23	1	Notebook on 11 Resonance, 1927-1937
	2	Notebook on Piezoelectricity, 1917-1924
		SERIES 2: CHAPTER DRAFTS FOR PIEZOELECTRICITY AN INTRODUCTION TO THE THEORY AND APPLICATIONS OF ELECTROMECHANICAL PHENOMENA IN CRYSTALS , 1945
14	5	Chapter Preface, 1945
	6	Chapter 1: Introduction, 1945
	7	Chapter 2: Crystallography, 1945
	8	Chapter 3: Crystal Elasticity, 1945
	9	Chapter 4: Rotated Axes and Transformation of Elastic Constants, 1945
15	1	Chapter 5: Vibrations of Crystals, 1945
	2	Chapter 6: Elastic Constants of Crystals, 1945
	3	Pi Index
	4	Chapter 7: Dielectric Properties of Crystals, 1945
	5	Chapter 8: Principles of Piezoelectricity, 1945
	6	Chapter 9: Special Piezoelectric Properties of Certain Crystals, 1945
	7	Chapter 10: Production and measurement of Piezoelectric Effects, 1945
	8	Chapter 11: Alternative Formulations of Piezoelectric Theory, 1945
	9	Chapter 12: Secondary Piezoelectric Effects
	10	Chapter 13: The Piezoelectric Resonator
	11	Chapter 14: The Electrical Equivalent of the Piezo-Resonator
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		SERIES 2: CHAPTER DRAFTS FOR PIEZOELECTRICITY AN INTRODUCTION TO THE THEORY AND APPLICATIONS OF ELECTROMECHANICAL PHENOMENA IN CRYSTALS, 1945
15	12	Chapter 15: The Dynamic Measurement of Piezoelectric and Equivalent Electrical Constants
	13	Chapter 16: Properties and Techniques of Quartz
16	1	Chapter 17: The Quartz Resonator
	2	Chapter 18: Resonators from Other Crystals and Composite Resonators
	3	Chapter 19: The Piezo-Oscillator
	4	Chapter 20: Rochelle Salt: History, General Properties and Technique

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	5	Chapter 21: Rochelle Salt Piezoelectric Observations
	6	Chapter 22: Rochelle Salt Dielectric Observations
	7	Chapter 23: Theory of Rochelle Salt, Part 1 the Interaction Theory and Dielectric Properties
	8	Chapter 24: Theory of Rochelle Salt, Part 2 Piezoelectric and Elastic Properties, Curie-Weiss Laws, and Conclusions
	9	Chapter 25: The Domain Structure of Rochelle Salt
	10	Chapter 26: Internal-Field Theory of Seignette-Electric Crystals
	11	Chapter 27: Other Seignette-Electric Crystals
	12	Chapter 28: Miscellaneous Applications of Piezoelectricity
	13	Chapter 29: Pyroelectricity
	14	Chapter 30: Piezo-optic, Electro-optic, and Other Optical effects
	15	Chapter 31: Piezoelectricity in the Light of Atomic Theory
17	13	Appendix 1: Ferromagnetism
	14	Name Index
	15	Subject Index
		SERIES 3: TECHNICAL REPRINT FILE, 1900s-1960s
23	3	Achyuthan, K.
	4	Adams, Edwin P.
	5	Adams, L.H.
	6	Adelsberger, von U.
	7	Adler, Laszlo
	8	Aggarwal, Ram Ratan
	9	Aircraft noise
	10	American Standards Association
	11	Anderson, J.A.
	12	Anderson, T.C.
	13	Ardenne, von Manfred
	14	Andreev, N.N. [Andrejew, von N.]
	15	Arenberg, David L.
	16	Armour Research Foundation
	17	Armstrong, E.J.
	18	Arnold, H.D.
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23	19	Atanasoff, John V.
	20	Awender, von Hans
	21	Baerwald, H.G.
	22	Bailitis, von Eduard
	23	Bajuline, P.
	24	Baker, W.O.

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	25	Balakrishna, S.
	26	Balamuth, Lewis
	27	Baldwin, William
	28	Ballatine, Stuart
	29	Banderet, Edmond
	30	Bantle, von Werner
	31	Baranski, K.N.
	32	Barnes, James M.
	33	Barr, E. Scott
	34	Barrett, R.E.
	35	Bartschi
24	1	Basri, S.A.
	2	Bates, Glen L.
	3	Bauer, L.A.
	4	Baum, Gilbert
	5	Bauzlin, Par P.
	6-7	Bechmann, von Rudolph
	8	Becker, von Gerhard
	9	Beckwith, T.D.
	10	Bell, G.D.
	11	Belser, Richard B.
	12	Bender, William
	12A	Benesch, O.
	13	Bennett, W.P.
	14	Benson, J.E.
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	16	Berlincourt, Don A.
	17	Bertsch, Carl V.
	18	Bettler, Philip C.
	19	Beyer, Robert T.
25	1	Bhagavantam, S.
	2	Bhismasenchar, J.
	3	Billings, Bruce H.
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	5	Bisang, Lothar
	6	Bloch, A.
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	8	Bloomenthal, Sidney
	9	Boella, Mario

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	10	Bokoy, S.A.
	11	Boley, F.I.
	12	Bond, W.L.
	13	Borgnis, F.E.
	14	Bosarelli, Cesare
	15	Bosshard, von W.
	16	Bottema, von O.
	17	Bouwkamp, C.J.
	18	Boyle, R.W.
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	2	Breazeale, M.A.
	3	Bridgman, P.W.
	4	Brody, S.S.
	5	Brown, S. Leroy
	6	Brown, William F.
	7	Brues, Charles T.
	8	Bruzau, M.
	9	Bureau of Standards
	10	Burlage, S.R.
	11	Burstein, Elias
	12	Busch, von G.
	13	Bristich Report on quartz crystal as a generator, 1943
	14	Cady, Willoughby Miller
	15	Carlin, Herbert J.
	16	Carpenter, R.O.
	17	Caspari, M.E.
	18	Casper, W.L.
	19	Cedrone, N.P.
	20	Ceramics
	21	Cerovska, J.
	22	Chakravarti, S.P.
	23	Chalupa, B.
	24	Chemical
	25	Ciaccia, Amleto
	26	Cobbold, G.W.N.
	27	Cohen, I.B.
	28	Cohen, Ira M.
	29	Cohen, Robert S.
	30	Collins, J.H.
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27	1	Cook, Bill D.
	2	Cook, E.G.
	3	Cook, Richard K.
	4-7	Cook, William R.
28	1-2	Cook William R.
	3	Cremer, Lothar
	4	Crossley, A.
	5	Curran, D. R.
	6	David, Rene
	7	Davies, R.M.
	8	Dawson, L.H.
	9	DeBretteville, A.
	10	Debye, P.
	11	D'Heedene, A.R.
	12	Del Grosso, V.A.
	13	Deresiewicz, H.
	14	Deutsch, Karl Wolfgang
	15	DeWael, J.
	16	Dinsdale, A.
	17	Doerffler, Heinz
	18	Dow, M. Thornton
	19	Duffy, J.
	20	Dunn, Floyd
	21	Drubba, von Helmut
	22	Duvall, G.E.
29	1	Dye, W.D.
	2	Eaton, Vernet E.
	3	Eccles, W.H.
	4	Echo Sounding
	5	Eckart, Carl
	6	Ehrlich, Stanley
	7	Einspruch, Norman G.
45	1	Einstein, A.
29	8	Eller, Eldon
	9	Ellis, A.T.
	10	Epstein, Paul S.
	11	Ernst, Paul J.
	12	Essen, L.
	13	Evans, Silas M.
	14	Fair, I.E.
	15	Faraday, Michael

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	16	Feaster, G.R.
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29	17	Feindt, von W.
	18	Ferrario, Mario
	19	Ficken, George W.
	20	Field, G.S.
	21	Fieschi, R.
	22	Firestone, Floyd A.
	23	Fischer, von Friedrich
	24	Fish, M.P.
	25	Flory, Paul J.
45	2	Flow, Turbulent
29	26	Focke, A.B.
	27	Forsbergh, Peter W.
	28	Fotland, Richard A.
	29	Foye, W.G.
	30	Fox, Francis E.
	31	Fox, Gerald W.
	32	Fraser, A.N.
	33	Fraser, D.B.
45	3	Freehafer, John E.
29	34	Freimann, von L.
	35	Froman, D.K.
	36	Frondel, Clifford
30	1	Fry, T.H.
	2	Fry, William J.
	3	Fujimoto, T.
	4	Fukuo, H.
	5	Fumi, F.G.
	6	Furuichi, J.
	7	Fushimi, Shoichi
	8	Gabel, Victor
	9	Gainon, Denis J.
	10	Galt, J.K.
	11	Gates, H.F.
	12	Gazis, D.C.
	13	George, William D.
	14	Gerber, E.A.
	15	Gerson, Robert
	16	Gerth, von F.

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	17	Gessert, W.L.
	18	Giebe, E.
	19	Golay, Marcel J.
	20	Goldberg, H.
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30	21	Goldman, Stanford
	22	Gordon, James
35	4	Gotz, von J.
30	23	Goyder, C.W.
	24	Gramont, M. Armand
	25	Granato, Andrew
	26	Grant, P.E.
	27	Greenspan, Martin
	28	Gregg, E.C.
	29	Greifer, Aaron P.
	30	Greninger, Alden B.
	31	Griffin, J.P.
	32	Griffing, Virginia
	33	Grifone, Nicola
31	1	Gronwall, T.H.
	2	Gruetzmacher, Johannes
	3	Grunbaum, Adolf
	4	Gunn, Ross
	5	[Guting?], L.J.
	6	Gutmann, F.
	7	Guttner, von Werner
45	5	Hablutzel, von J.
31	8	Hagen, von C.
	9	Hagenbach, August
	10	Hale, Danforth R.
	11	Hall, E.L.
	12	Hamilton, Andrew
	13	Hamilton, J.H.
	14	Hammond, D.L.
	15	Handel, von P.
	16	Harding, J.W.
	17	Hargrove, L.E.
	18	Harnwell, G.P.
45	6	Harris, Russell G.
31	19	Harrison, J.R.

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	20	Harrison, Walter A.
	21	Hartman, G.K.
	22	Harvard University
	23	Harvey, E. Newton
	24	Haskins, J.F.
	24A	Haupt,
	25	Hausler, E.
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31	26	Haviga, E.
	27	Hayward, Roger
	28	Hearman, R.F.S.
	29	Heaton, Vincent E.
	30	Heegner, Kurt
	31	Hehlgans, F.W.
	32	Henkel, John H.
	33	Herget, Carl M.
	34	Herrick, J.F.
	35	Herzog, von Werner
32	1	Hestenes, Arnold D.
	2	Hewlett-Packard
	3	Hiedemann, Egon A.
	4	Hikata, Akira
	5	Hinderlich, A.
	6	Hippel, A. von
	7	Hirsch, F.R.
	8	Hitchcock, R.C.
	9	Hoge, R.R.
	10	Hogg, Benjamin
	11	Holden, A.N.
	12	Holton, G.H.
	13	Holton, Gerald J.
	14	Horton, J.W.
	15	Hostetter, J.C.
	16	Hovgaard, O.M.
	17	Howatt, G.N.
	18	Howry, Douglass, H.
	19	Hubbell, H.H.
	20	Huentner, T.F.
	21	Hull, A.W.
	22	Hund, August

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	23	Hunt, F.V.
	24	Hunter, R.S.
	25	Huntington, H.B.
	26	Hurley, D.
	27	Huter, Theodor
	28	Hussey, L.W.
	29	Iida, Kumizi
	30	Ikeda, Takuro
	31	Ingerson, Earl
	32	Ives, Herbert E.
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32	33	Iyengar, K.S.
	34	Jackson, C.H.
	35	Jacobsen, Lydik S.
	36	Jaffe, Bernard
	37	Jaffee, Hans
	38	Janszen, A.A.
	39	Jauncey, G.E.M.
33	1	Jimbo, Seikichi
	2	John, Ulrich von
	3	Johnson, Walter H.
	4	Jones, O.E.
	4A	Jordan, von Pascual
	5	Judd, Deane B.
	6	Junger, Miguel
	7	Juretschke, Hellmut
	8	Jurmain, Jacob H.
	9	Kane, T.R.
	10	Kannuna, M.M.
	11	Karapetoff
	12	Kauter, W.
	13	Keary, W.V.
	14	Keat, Paul P.
	15	Keith, M.L.
	16	Keller, A.C.
	17	Kerr, Paul F.
	18	Khol, Franz
	19	Kiebitz, M.F.
	20	Kikuchi, Yoshimitsu
	21	King, J.C.

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	22	King, Louis V.
	23	Kishimoto, Tadashi
	24	Kittel, Charles
	25	Klein, Elias
	26	Klein, W.R.
	27	Klickstein, Herbert S.
	28	Klooster, H.S. von
	29	Knol, K.S.
33	30	Kobzarev
45	7	
	31	Koenig, J.
34	1	Koga, Issac
	2	Kogl, F.
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34	3	Kolb, J.
	4	Kracek, Frank C.
	5	Krishnamurthi, Bh.
	6	Krista, Franz
	7	Kron, Gabriel
45	8	
	8	Krueger, Helmut H.A.
	9	Krustallos
	10	Kryropoulos, S.
	11	Kulcsar, Frank
	12	Kurtschatow
	13	Kyame, Joseph John
	14	Labaw, L.W.
	15	Lack, F.R.
	16	Land, Edwin
	17	Landon, D.H.
	18	Lane, C.T.
	19	Lang, Sidney
	20	Lapham, E.G.
	21	Laval, Jean
	22	Lavine, Oscar
	23	Lawley, L.E.
	24	Lawson, A.W.
	25	Lee, Reuben
	26	Leithauser, Von G.
	27	Lester, W.W.

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	28	Lewis, E.P.
	29	Lindberg, A.
	30	Lindsay, R.B.
	31	Lion, Kurt S.
	32	List, b.H.
	33	Little, A.D.
	34	Little, Elizabeth
35	1	Loeber, A.P.
	2	Lucke, Kurt
	3	Ludloff, Von H.
	4	McKay, H.C.
	5	McKeehan, L.W.
	5A	McKeena, Q.C.
	6	McKinley, D.W.
	7	McMillan, Edwin M.
	8	Machlup, S.
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		SERIES 3: TECHNICAL REPRINT FILE, 1900s-1960s
35	9	Malatesta, S.
	9A	Maling, Edwin
	10	Mallett, E.
	11	Mandell, W.
	12	Mandelstam, von L.
	13	Markham, Jordan J.
	14	Marlow, D.G.
	15	Marrison, W.A.
	16	Maryin, Gordon E.
	17	Marutake, Masakazu
	18-19	Mason, W.P.
	20	Matsumura, Sadao
	21	Matthias, B.
	22	Mattiat, von Oscar
	23	Mayer, M.
	24	Mayer, W.G.
36	1	Meibner, von A.
	2	Meier, von Rudolf
	3	Meissner, A.
	4	Meitzler, A.H.
	5	Mendousse, J.S.
	6	Mercier, A.
	7	Merrill, F.G.

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	8	Merz, W.J.
	9	Metz, Frank A.
	10	Meyerhoff, D.
	11	Michalec, R.
	12	Mickey, L.
	13	Miller, H.B.
	14	Miller, John M.
	15	Miller, R.B.
	16	Miller, W.D.
	17	Mindlin, Raymond
	18	Mitchell, J.W.
	19	Mitsuda, Ryotaro
	20	Mitsui, Toshio
	21	Miyakawa, Kozaburo
	22	Miyake, Shizuo
	23	Mizokami, Kei
	24	Mohler, Nora M.
	25	Montillon, G.H.
	26	Morse, R.W.
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36	27	Morton, G.A.
	28	Moulin, M.
	29	Mueller, Hans
	30	Muser, von Horst E.
37	1	Namba, Shogo
	2	Nancarrow, F.E.
	3	Narasimhamurty, T.S.
	4	National Physical Laboratory
	5	National Research Council
	6	Naude, Charl F.
	7	Navy's contribution to radio
	8	Nenadkewitch, K.
	9	Newman, E.G.
	10	Newton, R.R.
	11	Nichols, John T.
	12	Nickerson, Dorothy
	13	Nielsen, R.A.
	14	Nishikawa, S.
	15	Noelle, E.W.
	16	Noltingk, B.E.

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	17	Nomoto, Otohiko
	18	Nyborg, Wesley L.
	19	Oggioni, Guido
	20	Ohara, Gisaku
	21	Olson, H.F.
	22	Onoe, Morio
	23	Oplatka, G.
	24	Osterberg, Harold
	25	Osterhammel, Von K.
	26	Otpushtshennikov, N.F.
	27	Pao, Yoh-Han
	28	Palmer, Ralph S.
	29	Parker, J.G.
38	1	Parker, Paul M.
	2	Parmenter, R.H.
	3	Parthasarathy, S.
	4	Pellam, John R.
	5	Perrier, Albert
	6	Perrine, J.O.
	7	Petermann, L.A.
	8	Petrzilka, V.
	9	Phipps, T.E.
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38	10	Physikalisch-Technischen
	11	Pielemeier, W.H.
	12	Pierce, George W.
	13	Piezo Crystals, Ltd.
	14	Pitt, Arnold
	15	Planck, von Max
	16	Plass, K.
	17	Plasticity
	18	Plesset, M.S.
	19	Pohlman, Reimer
	20	Pollack, Fred H.
	21	Pontecorvo, Paolo
	22	Porter, Bernard H.
	23	Post, E.J.
	24	Prasada, G.H. S.V.
	25	Price, William J.
	26	Pritchard, Robert L.

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39	1	Quartz clocks
	2	Quartz crystal units
	3	Quigley, S.J.
	4	Quimby, S.L.
	5	Raman, C.V.
	6	Rander, Mary Ellen
	7	Raney, W.P.
	8	Rao, S. Ramachandra
	9	Rao, T. Seshagiri
	10	Rapuano, Robert A.
	11	Raudebaugh, R.J.
	12	Ravindranath, T.
	13	Rayner, E.H.
	14	Richardson, E.G.
	15	Ringo, G.R.
	16	Robbins, Billy A.
	17	Roberts, Shepard
	18	Robey, D.H.
	19	Rogers, Austin F.
	20	Rogers, Henry H.
	21	Rose, Fred C.
	22	Rosenberg, Murray D.
	23	Rosenberg, Paul
45	9	Rosani, S.
39	24	Rothauge, Charles H.
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39	25	Roethermel, R.A.
	26	Ruedy, R.
	27	Rust, von Hans Heinrich
	28	Rusterholz, von Alexander A.
40	1	Sanden, von Kurt
	1A	Sanders, F.H.
	1B	Sanderson, J.A.
	2	Saneyoshi, Jun-Ichi
	3	Saunders, Frederick A.
	4	Sawaguchi, Etsuro
	5	Sawyer, C. Baldwin
	6	Schaefer, C.
	7	Schaefer, J.P.
	8	Scheibe, Von A.

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	8A	Schelkunoff, S.A.
	8B	Scherrer, P.
	8C	Scholz, H.
	9	Schroder, F.K.
	10	Schumacher, von R.O.
	11	Schuster, von Kurt
	12	Schwartz, von Erich
	13	Schweinler, H.C.
	14	Selover, E.E.
	15	Sette, Daniele
	16	Shapiro, Jonas M.
	17	Shapley, Harlow
	18	Shear, Sidney K.
	19	Shibayama, K.
	20	Shockley, W.
	21	Shropshire, R.F.
	22	Shulvas-Sorokina, R.D. [alternate spelling Schulwas-Sorokin]
	23	Simons, Eric N.
	24	Skellett, A.M.
	25	Slater, John C.
	26	Sliker, T.R.
	27	Smirnov, V.A.
41	1	Smith, Preston W.
	2	Smith, W.L.
	3	Smyth, C.N.
	4	Smyth, J.B.
	5	Sokoloff, A.
	6	Sondheimer, E.H.
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41	7	Sosman, Robert B.
	8	Soule, Floyd A.
	9	Speight, James W.
	10	Spitzer, von Friedrich
	11	Stakutis, V.J.
	12	Stanford Research Institute
	13	Stansel, Frank
	14	Statton, W.O.
	15	Staub, Hans
	16	Stenzel, von H.
	17	Sternfeld, Frederick W.

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	18	Stetson, H.T.
	19	Stevens, George T.
	20	Stevens, H.C.
	21	Stewart, Ellen and James
	22	Straubel, von Harald
	23	Strock, Morris S.
	24	Stolt, Helge
	25	Subrahmanyam, S.V.
	26	Sundara, R.V.G.
	27	Suryanarayana, D.
	28	Sutton, Paul
	29	Suzuki, Tetsuro
	30	Swann, W.F.G.
	31	Sykes, R.A.
42	1	Tawil, M. Edgar-Pierre
	2	Taylor, A.H.
	3	Taylor, G.B.
	4	Taylor, R.
	5	Teeter, Charles Edwin
	6	Terry, Earle M.
	7	Thorndike, A.M.
	8	Thorne, Oakleigh
	9	Tournier, M.
	10	Trevis, M.J.
	11	Trommler, H.
	12	Trowbridge, C.C.
	13	Truell, Rohn
	14	Tsi-Ze, M. NY
	15	Tumansky, S.S.
	16	Tuttle, O.F.
	17	Tykociner, J.
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42	18	Ueda, Ryuzo
	19	Ultra
	20	Ungeheuer, E.
	21	USSR
	22	Usui, Rensuke
	23	Valasek, J.
	24	[Vallaun?]
45	10	Vallauri, Giancarlo

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42	25	Valkenburg, H.E. Van
	26-27	Van Dyke, Karl S.
45	11	Vecchiacchi, F.
43	1	Van Iherbeek, A.
	2	Ventouratos, Phedon G.
	3	Victor Electronic Systems Co.
	4	Vigoreux, J.E.P.
	5	Vincent, Coye T.
	6	Von Karman, Theodore
	7	Walker, A.C.
	8	Walker, Thomas J.
	9	Walstrom, J.E.
	10	Ward, W. Dixon
	11	Warner, A.W.
	12	Watanabe, Yasusi
	13	Waterman, P.C.
	14	Weisberg, Leonard
	15	Wente, E.C.
	16	Western Reserve University
	17	Westervelt, Peter J.
	18	Wheeler, L.P.
	19	White, D.L.
	20	White, J.E.
	21	White, S. Young
	22	Willard, G.W.
	23	Williams, A.O.
	24	Wilson, A.J.C.
45	12	Winters, S.A.
43	25	Winthrow, Robert B.
	26	Wolfe, C.W.
	27	Wood, Harry O.
	28	Wooster, W.A.
	29	Worrall, Robert H.
	30	Wright, R.B.
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43	31	Wyckoff, Ralph
44	1	Yariv, A.
	2	Yeager, Ernest
	3	Ying, C.F.
	4	Yoder, Hatten

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	5	Zacek, A.
	6	Zacharias, Jerrold
	7	Zankel, K.L.
	8	Zartmann, I.F.
	9	Zelenka, Jiri
	10	Zottu, Paul D.
	11	SERIES 4: WALTER G. CADY WRITINGS AND REVIEWS, 1950s-1960s
		SERIES 5: CONSULTANT WORK, 1931-1967
	12	Academy of Applied Science, 1963-1967
	13	American Academy of Arts & Sciences, 1963-1968
	14	Air Force—Composite Resonator
	15	Air Force—Plane Wave Acoustic Filter
	16	Air Force—High Frequency Ultrasonics
	17	Air Force—Project Jericho, 1959
	18	Cal Tech—Acoustic Radiation Pressure, Status Reports, 1951-1953
	19	Cal Tech—Acoustic Radiation Pressure, Report #1, 1952
	20	Cal Tech—Acoustic Radiation Pressure, Report #1A, 1953
	21	Cal Tech—Acoustic Radiation Pressure, Report #2, 1951-1952
45	13	Cal Tech—Acoustic Radiation Pressure, Report #3, 1952-1955
44	22	Cal Tech—Acoustic Radiation Pressure, Report #4, 1952-1955
	23	Cal Tech—Acoustic Radiation Pressure, Report #5, 1953
	24	Curtiss-Wright Corporation, 1956-1957
46	1	Condenser Radiometer, 1947
	2	Consulting—General Notes
	3	Cooperative Wind Tunnel, 1956
	4	Graphical Aids in Interpreting the Performance of Crystal Transducer
	5	Gyulton industries, Inc. 1960
	6	Hayes Sprinkler, 1959
	7	Lockheed Electronics Co. 1961
	8	Marketing correspondence, 1966-1967
	9	Military Electronics, 1957-1958
	10	Office of Naval Research/Wesleyan University—Report information and correspondence, 1948-1950
	11	Office of Naval Research/Wesleyan University—Report #1, 1949
	12	Office of Naval Research/Wesleyan University —Theory of Crystal Transducer for Plan Waves, Report #2, 1948
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		SERIES 5: CONSULTANT WORK, 1931-1967
46	13	Office of Naval Research/Wesleyan University —Measurement of Transducer Input and Output, Report #3, 1951

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	14	Office of Naval Research/Wesleyan University —Measurement of Specific Acoustic Resistance of Liquids, Report # 4, 1950
	15	Office of Naval Research/Wesleyan University —Theory of Acoustic Radiation pressure, Report #5, 1949-1950
	16	Office of Naval Research/Wesleyan University —Capacitance Bridge, Report #6, 1950-1951
	17	Office of Naval Research/Wesleyan University —Report #7, 1953
	18	Office of Naval Research/Wesleyan University —Generalized Theory of Crystal Transmitter and Receiver for Plane Waves, Report #8, 1953
47	1	Office of Naval Research/Wesleyan University —Status Reports 31-#14, 1947-1950
	2-2A	Office of Naval Research/Wesleyan University —Correspondence, 1951-1953
	3	Radiation Lab, 1945
	4	Raynthon Electronics Corp. Catalog, n.d.
	5	Variable Frequency Interferometer, 1950-1951
	6	Westrex Corp. 1959
	7	Wired Radio Inc. 1931-1932
		SERIES 6: INSTITUTE OF RADIO ENGINEERS, 1945-1963
	8	By-Laws, 1965
	9	IRE Definitions, 1959
	10	IRE Standards listing, n.d.
	11	Standards, 1945
	12	Standards, 1949
	13	Standards, 1954
48	1	Standards, 1955
	2	Standards, 1956
	3	Standards, 1957
	4	Standards, 1958
	5	Standards, 1959
	6	Standards, 1961
	7	Standards, 1962
	8	Standards, 1963
	9	Committee on Piezoelectric Crystals, 1951-1956
	10	Committee on Piezoelectric and Ferroelectric Crystals, 1961-1964, 1966
	11	Committee on Standards, 1951
	12	International Electrotechnical Commission, 1954
	13	Professional Groups Manual, 1952
	14	Twentieth Anniversary Convention, 1932
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SERIES 7: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE), 1932-1973		
49	1	Committee on Frequency Control and Measurement, 1966
	2	Committee on Frequency and Time, 1967-1973
	3	Committee on Piezoelectric and Ferroelectric Crystals, 1963
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50	1	Acoustic Impedance Measuring Device for Liquids, 1948-1951
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	12	Electromechanical system, 1930 #1,781,680

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		SERIES 10: MISCELLANEOUS, 1949-1973
51	4	Accelerometer, n.d.
	5	Akademie der Wissenschaften, 1949-1955
	6	American Institute of Physics, 1963-1968
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		SERIES 11: CARD INDEX FILES, 1940s-1960s
52		A-P, 1940-1960 Abstracts of scientific articles and reports; sources, authors
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