TABLE OF CONTENTS

Personnel		vi
Publications and Reports		ix
Introduction		xi
I.	Physical Electronics	1
	Electron-Emission Problems	1
	Thermionic Work Function and Conductivity of Oxide-Coated Cathodes	1
	Magnetic Velocity Analyzer Investigation of Thermionic Emission from Tungsten	2
	Photoelectric Emission	4
	Photoelectric Study of Surface States on Insulators	5
	The Influence of Electric Field and Temperature on Field Emission from Tungsten	5
	Studies with Gas Discharge	6
	Probe Measurements in a Low-Pressure Mercury Arc	6
	Experimental Techniques	7
	Ionization Gauge Studies	7
II.	Microwave Gaseous Discharges	8
	Electron Density Measurements in D-C Discharges	8
	Electron Collision Cross Sections	9
	Positive Ion Analysis	12
III.	Solid State Physics	13
	Extension of the Energy Band Theory	13
	Self-Consistent Field Calculations	17
	Energy Bands in Solids	17
,	Theory of Molecular Oxygen	18
	Ferroelectricity in the Ilmenite Structure	18
	Cr·6H ₂ O ⁺⁺⁺ Complex in Chrome Alums	19
	Effect of Configuration Interaction on the Magnetic Hyperfine Interaction	19
	Theory of Superconductivity	21
	Soft X-Ray Vacuum Spectrograph	21
	Paramagnetic Resonance Experiments	22
IV.	Low-Temperature Physics	24
	Helium Liquefiers	24
	Magnetic Dipole Interactions in Crystals	25
	Resistance Minimum Measurements	25
	Thermomechanical Effect in Liquid Helium II	26
	Temperature and Pressure Dependence of the Viscosity of Liquid Helium	26

	Specific Heat of Liquid Helium	27
	Measurement of Second-Sound Pulse Heights in Liquid Helium II	27
	Wave Impedance of Liquid Helium II in the Nonequilibrium Theory	28
V.	Microwave Spectroscopy	29
VI.	Magnet Laboratory Research	30
	Nuclear Magnetic Resonances	30
	Medium-Field Homogeneity of the Barrel-Type Electromagnet	30
	Li ⁷ - Li ⁶ Nuclear Magnetic Moment Ratio	30
	Double Resonance Experiments	31
	Effects in Mercury	31
	Effects in Alkalis	31
VII.	Tube Research and Development	32
	Magnetron Development	32
	High-Power 10.7-Cm Magnetron	32
	Magnetron Research	35
	Microwave Tubes	35
	Noise and Space Charge Waves	35
	Analysis of power in electron beam	35
	Experimental noise study	35
	Noise reduction by a two-stage electron gun	37
	3-Cm Pulsed Traveling Wave Source	38
	Power output tube	38
	Driver tube	39
	High-Power Traveling Wave Tubes	39
	Operation of Pulsed Magnetrons into a High Q-Load	39
	l-Mev Pulsed Electron Source	41
	Tube	41
	Modulator	41
VIII.	Communication Research	43
	Multipath Transmission	43
	Speech and Music	43
	Television	43
	Statistical Theory of Communication	45
	Single-Channel Analog Correlator	45
	Multichannel Correlator	46
	Digital Electronic Correlator	46
	Pulse Code Magnetic Recorder	48
	Felix (Sensory Replacement)	50
	Amplitude Distributions of Filtered Speech	50

	Brain Wave Investigations	50
	Human Communication Systems	52
	Experiment on Network Patterns and Group Learning	52
	Octopus	52
	A Study of the Problems of Recognition and Linguistic Encoding of Complex Patterns	52
	On the Combinatorial Analysis of Networks	54
	Slightly Lossy Networks	57
	Compensation for Incidental Dissipation in Network Synthesis	57
	New Methods of Network Synthesis	58
	Transient Problems	60
	On the Electrical Reproduction of Bounded Functions in a Given Interval and Time-Domain Synthesis	60
	Synthesis in the Time Domain	75
IX.	Air Navigation	76
X .	Analog Computer Research	77
	The Operation of Present Computers	77
	The Design of New Computing Elements	77