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	3
	Studies with Gaseous Discharge	5
	Low-Pressure Mercury Arcs	5
	Experimental Techniques	5
	Spectral Emissivity of Tungsten	5
	Ionization Gauge Studies	6
II.	Microwave Gaseous Discharges	9
	Breakdown in Hydrogen at 100 Mc	9
	Vacuum Valve	12
	Collision Probability Measurements	12
III.	Solid State Physics	14
	Extension of the Energy Band Theory	14
	Self-Consistent Calculations for Cu^{+}	16
	Energy Bands in Solids	17
	Theory of Molecular Oxygen	18
	On the Ferroelectricity of the TiO_6 Complex	20
	Ferroelectricity in the Ilmenite Structure	23
	Ions in a Cubic Electric Field	24
	Soft X-Ray Vacuum Spectrograph	24
	Paramagnetic Resonance Experiments	26
IV.	Low-Temperature Physics	28
	Helium Liquefiers	28
	Pressure Variation of Second Sound Velocity in Liquid Helium II	28
	Magnetic Dipole Interactions in Crystals	30
	Resistance Minimum Measurements	30
	Thermomechanical Effect in Liquid Helium II	31
	Temperature and Pressure Dependence of the Viscosity of Liquid Helium	31
	Specific Heat of Liquid Helium	32

V. Microwave Spectroscopy 33
Organic Molecules 33
Deutero-Ammonias 34
Ketene 35
Nuclear Magnetic Moment of S^{33} 40
Electric Quadrupole Coupling of the S^{33} Nucleus in $O^{16}C^{12}S^{33}$ 41
VI. Magnet Laboratory Research 44
Nuclear Magnetic Resonances 44
Ratio of Moments of Rb 85 and 87 44
Low Field Homogeneity of the Barrel-Type Electromagnet 44
Deuteron-Proton Moment Ratio 45
Double Resonance Experiments 45
Effects in Mercury 45
Effects in Alkalis 46
Magnetic Properties of Solids 46
The Rare Earths 46
Adiabatic Demagnetization 46
VII. Tube Research and Development 47
Magnetron Development 47
High-power 10.7-Cm Magnetron 47
Magnetron Research 49
Microwave Tubes 50
Noise and Space Charge Waves 50
3-cm Pulsed Traveling Wave Tube 50
Traveling Wave Tube Used as a Mixer 51
3-cm Traveling Wave Tubes 51
Operation of Pulsed Magnetrons into a High Q Load 51
High-Energy Electron Source 56
VIII. Communication Research 59
Multipath Transmission 59
Field-Test Receivers 59
Noise-Reducing Circuits 59
Television 62
Statistical Theory of Communication 64
Single-Channel Electronic Analog Correlator 64
Multichannel Electronic Analog Correlator 64
Noise in Nonlinear Devices 64
Techniques in Optimum Filter Design 64
Interference Filtering 64

Digital Electronic Correlator 65
Correlation Techniques in Electro-Acoustic Measurements 65
A Short-Time Correlator for Speech Waves 66
An Electrical Analog of the Cochlea 67
Information Theory 70
Digital Coding 70
Pulse Code Magnetic Recorder 72
Felix (Sensory Replacement) 75
Brain Wave Investigations 76
Human Communication Systems 78
Communication Pattern and the Adaptability of Task-Oriented Groups 78
Experiments on Network Patterns and Group Learning 79
Mathematical Approaches to Networks 80
"Octopus" 82
Transient Problems 85
Linear Frequency Variation Transients 85
Synthesis in the Time Domain 90
Slightly Lossy Networks 92
Compensation for Incidental Dissipation in Network Synthesis 92
IX. Air Navigation 94
X. Analog Computer Research 97
Operation of Present Computers 97
Integral Equation Computer 97