

TABLE OF CONTENTS

	Page
Chapter 1	
BASIC PHYSICAL CONCEPTS.....	1
1.1 Introduction. — 1.2 Electric Charge. — 1.3 The Electron. — 1.4 The Electric Field. — 1.5 The Magnetic Field. — 1.6 Electromagnetic Fields.	
Chapter 2	
DIRECT CURRENT AND DIRECT-CURRENT CIRCUITS.....	5
2.1 Direct Current Flow. — 2.2 Electric Pressure or Electromotive Force. — 2.3 Resistance. — 2.4 Current. — 2.5 The Volt. — 2.6 Open Circuits. — 2.7 Electrical Symbols and Circuit Conventions. — 2.8 Ohm's Law. — 2.9 Other Ways of Expressing Ohm's Law. — 2.10 Potential Differences in a Closed Circuit. — 2.11 Internal Resistance. — 2.12 Electric Power. — 2.13 Properties of Electric Conductors.	
Chapter 3	
THE SOLUTION OF D-C NETWORKS	13
3.1 Series Circuits. — 3.2 Parallel Circuits. — 3.3 Kirchoff's First Law. — 3.4 Conductance. — 3.5 Direct-Current Networks. — 3.6 Kirchoff's Second Law. — 3.7 Networks Containing More Than One Source of Emf.	
Chapter 4	
MAGNETS AND MAGNETIC CIRCUITS.....	20
4.1 Nature of Magnetism. — 4.2 Permanent Magnets. — 4.3 The Magnetic Circuit. — 4.4 Electromagnets. — 4.5 Relation Between Current and Field Intensity. — 4.6 Flux Density, Field Intensity and Permeability. — 4.7 Magnetic Properties of Iron. — 4.8 B-H Curves. — 4.9 Hysteresis.	
Chapter 5	
ELECTRICAL MEASUREMENTS IN DIRECT-CURRENT CIRCUITS.....	28
5.1 Measuring Instruments. — 5.2 Simple Resistance Measurements. — 5.3 Insulation Measurements. — 5.4 Theory of the Wheatstone Bridge. — 5.5 Simple Loop Tests or Plain Resistance Measurements. — 5.6 Varley Loop Tests. — 5.7 Murray Loop Tests.	
Chapter 6	
THE DIRECT-CURRENT DYNAMO-ELECTRIC MACHINE.....	42
6.1 Induced Electromotive Force. — 6.2 Emf Induced in a Revolving Loop. — 6.3 Principle of the Direct-Current Generator. — 6.4 D-C Generators for Supplying Central Office Power. — 6.5 Typical Central Office Power Plant. — 6.6 Direct-Current Motors.	
Chapter 7	
OTHER SOURCES OF DIRECT ELECTROMOTIVE FORCE.....	50
7.1 Types of D-C Energy Sources. — 7.2 Primary Batteries. — 7.3 Storage Batteries. — 7.4 Power Plant Requirements in Telephone Offices. — 7.5 Rectifiers.	

Table of Contents—(Continued)

	Page
Chapter 8	
INDUCTANCE AND CAPACITANCE.....	56
8.1 Classification of Electric Currents. — 8.2 Changes in Direct-Current Values. — 8.3 Inductance. — 8.4 Capacitance. — 8.5 Effects of Inductance and Capacitance in Direct-Current Circuits.	
Chapter 9	
TELEPHONE PRINCIPLES AND BASIC APPARATUS.....	64
9.1 Sound. — 9.2 The Simple Telephone Circuit. — 9.3 The Telephone Receiver. — 9.4 The Telephone Transmitter. — 9.5 Resistors, Inductors and Capacitors. — 9.6 Relays and Switches.	
Chapter 10	
TELEPHONE CIRCUITS	75
10.1 The Telephone Subscriber Set. — 10.2 The Telephone Central Office. — 10.3 Manual Switching Systems. — 10.4 Dial Switching Systems. — 10.5 Toll Dial Switching. — 10.6 Signaling.	
Chapter 11	
TELEGRAPH CIRCUITS	89
11.1 Means of Obtaining Telegraph Circuits. — 11.2 The Elementary Telegraph Circuit. — 11.3 The Single Line Repeater. — 11.4 Differential Duplex Systems. — 11.5 Principle of the Vibrating Circuit. — 11.6 Polarential Systems. — 11.7 Metallic Telegraph Systems.	
Chapter 12	
TELEGRAPH CIRCUITS (Continued).....	100
12.1 Principles of the Teletypewriter. — 12.2 Operating Characteristics of Teletypewriter Systems. — 12.3 The Regenerative Repeater. — 12.4 Teletypewriter Switching Systems.	
Chapter 13	
TELEGRAPH TRANSMISSION PRINCIPLES.....	109
13.1 Nature of Telegraph Signals. — 13.2 Wave Shapes in Neutral Telegraph Systems. — 13.3 Bias Distortion. — 13.4 Wave Shapes in Polar Telegraph Systems.	
Chapter 14	
TELEGRAPH TRANSMISSION PRINCIPLES (Continued).....	116
14.1 Characteristic Distortion. — 14.2 Fortuitous Distortion. — 14.3 Teletypewriter Margin Measurements. — 14.4 Telegraph Transmission Measuring Sets.	
Chapter 15	
ALTERNATING CURRENTS	124
15.1 Source of Alternating Emf. — 15.2 The Sine Wave. — 15.3 Phase Relations and Vector Notation. — 15.4 Effective Emf and Current Values. — 15.5 Power in A-C Circuits. — 15.6 Ohm's Law and Alternating-Current Calculations. — 15.7 Inductive Reactance. — 15.8 Capacitive Reactance. — 15.9 Combination of Inductive and Capacitive Reactance. — 15.10 Impedance.	

Table of Contents—(Continued)

Chapter 16		Page
ALTERNATING CURRENTS (Continued)		136
16.1 Series Networks. — 16.2 Parallel and Series-Parallel Networks. — 16.3 Alternating-Current Resistance. — 16.4 Resonance. — 16.5 "Q".		
Chapter 17		
REPEATING COILS AND TRANSFORMERS		144
17.1 Mutual Inductance. — 17.2 Theory of the Transformer. — 17.3 Transformer Applications to Telephone Circuits. — 17.4 The Phantom Circuit. — 17.5 Standard Repeating Coils. — 17.6 Air-Core Transformers. — 17.7 The Hybrid Coil.		
Chapter 18		
TELEPHONE TRANSMISSION THEORY		154
18.1 The Transmission System. — 18.2 Transfer of Power. — 18.3 Thevenin's Theorem. — 18.4 Equivalent Networks. — 18.5 Characteristic Impedance. — 18.6 Propagation Constant.		
Chapter 19		
TELEPHONE TRANSMISSION THEORY (Continued)		164
19.1 Loading. — 19.2 Total Losses in the Transmission System. — 19.3 Coaxial Conductors. — 19.4 Units for the Measurement of Transmission Losses and Gains.		
Chapter 20		
TELEPHONE TRANSMISSION THEORY (Continued)		169
20.1 Wave Propagation. — 20.2 Reflections on Transmission Lines. — 20.3 Electromagnetic Radiation. — 20.4 Radio Transmission. — 20.5 Waveguides.		
Chapter 21		
CHARACTERISTICS OF CIRCUIT FACILITIES		175
21.1 Classification of Wire Facilities. — 21.2 Open Wire Facilities. — 21.3 Toll Cable Facilities. — 21.4 Toll Entrance and Intermediate Cable Facilities.		
Chapter 22		
ATTENUATION, IMPEDANCE MATCHING AND EQUALIZING NETWORKS		184
22.1 Pads or Attenuators. — 22.2 Impedance Matching. — 22.3 Attenuation Equalizers. — 22.4 Bridged T-Equalizers. — 22.5 Delay or Phase Equalizers.		
Chapter 23		
FILTERS		194
23.1 Filter Requirements. — 23.2 Low- and High-Pass Filter Sections. — 23.3 M-Derived Filter Sections. — 23.4 Composite Filters. — 23.5 Band Filters. — 23.6 Crystal Filters. — 23.7 Lattice Networks. — 23.8 Radio-Frequency Filters. — 23.9 Waveguide Filters.		

Table of Contents—(Continued)

	Page
Chapter 24	
ELECTRON TUBES	210
24.1 Vacuum Tube Elements. — 24.2 Two-Electrode Tubes-Diodes. — 24.3 Three-Electrode Tubes-Triodes. — 24.4 Dynamic Characteristics of Tubes. — 24.5 Multi-Electrode Tubes.	
Chapter 25	
ELECTRON TUBES (Continued)	218
25.1 Gas Tubes. — 25.2 Phototubes. — 25.3 The Cathode-Ray Tube. — 25.4 The Klystron.	
Chapter 26	
AMPLIFIER CIRCUITS	223
26.1 Audio-Frequency Amplifiers. — 26.2 Resistance-Capacitance Coupled Amplifiers. — 26.3 Radio-Frequency Amplifiers. — 26.4 Negative-Feedback Amplifiers. — 26.5 The Cathode-Follower. — 26.6 Power Amplifiers. — 26.7 The Transistor as an Amplifier.	
Chapter 27	
AMPLIFIER APPLICATIONS IN TELEPHONE PRACTICE	233
27.1 Telephone Repeaters. — 27.2 Carrier Amplifiers. — 27.3 Broad-Band and Superhigh-Frequency Amplifiers.	
Chapter 28	
RECTIFIER, DETECTOR, OSCILLATOR AND OTHER ELECTRON TUBE CIRCUITS	241
28.1 Electron Tube Rectifiers. — 28.2 Detectors. — 28.3 Discriminators. — 28.4 Oscillators. — 28.5 Wave-Shaping Circuits.	
Chapter 29	
MODULATION	252
29.1 The Carrier Principle. — 29.2 Amplitude Modulation. — 29.3 Frequency Modulation. — 29.4 Pulse Modulation.	
Chapter 30	
LONG DISTANCE TRANSMISSION SYSTEMS— VOICE-FREQUENCY TELEPHONE CIRCUITS	265
30.1 Types of Telephone Transmission Systems. — 30.2 Repeater Spacing. — 30.3 Repeater Gains and Transmission Levels. — 30.4 Return Loss and Singing Points. — 30.5 Balancing Networks. — 30.6 Transmission Regulation. — 30.7 Echo Control.	
Chapter 31	
CARRIER SYSTEMS	277
31.1 Types of Carrier Systems. — 31.2 Carrier Telegraph Systems. — 31.3 Type-C Carrier Telephone System. — 31.4 Type-J Carrier Telephone System. — 31.5 Type-K Carrier Telephone System.	

Table of Contents—(Continued)

Chapter 32		Page
CARRIER SYSTEMS (Continued)		294
32.1 Type-L Carrier Systems. — 32.2 Television Transmission on Carrier Systems. — 32.3 Type-N Carrier System. — 32.4 Type-O Carrier System.		
Chapter 33		
RADIO SYSTEMS		312
33.1 Types of Radio Systems. — 33.2 Radio Transmitters. — 33.3 Radio Receivers. — 33.4 Antennas. — 33.5 Microwave Radio Relay System.		
Chapter 34		
NOISE AND CROSSTALK		326
34.1 Induced Effects in Telephone Circuits. — 34.2 Causes of Crosstalk. — 34.3 Principles of Crosstalk Reduction. — 34.4 Crosstalk Reduction Practices. — 34.5 Noise. — 34.6 Crosstalk and Noise Measuring Units.		
Chapter 35		
ALTERNATING-CURRENT MEASUREMENTS		339
35.1 Alternating-Current Meters. — 35.2 The Cathode-Ray Oscilloscope. — 35.3 Frequency Measurements. — 35.4 Impedance Measurements. — 35.5 Transmission Measurements. — 35.6 Measurements at Super-High Frequencies.		

TABLES

	Page
I Symbols Used in Electrical Work.....	9
II Resistivity of Various Metal Conductors.....	9
III Electrical Properties of Copper Conductors.....	11
IV Dielectric Power of Various Insulating Materials.....	61
V Conventional Symbols Commonly Used in A-C Work.....	129
VI Chart of Vector Relations.....	133
VII Standard Repeating Coils.....	149
VIII Relation Between Decibels and Power Ratios for Gains and Losses.....	167
IX Characteristics of Open Wire Telephone Circuits.....	178
X Characteristics of Cable Telephone Circuits.....	180
XI Loading Coil Spacing Code.....	181
XII Series and Shunt Resistance Values of Square Pads.....	186
XIII Variations in Transmission Equivalents of Cable Circuits Due to Temperature Changes	272