

Contents

LIST OF TABLES	ix
PREFACES TO 1ST AND 4TH EDITIONS	xi
1 FLOW OF FLUIDS	1
Functions of the Conveying Fluid—Standard Air—Compressibility—Suspended Solids—Static, Velocity, and Impact Pressures—Units of Pressure, Velocity, and Volume—Static Pressure: A Measure of Resistance—Measurement of Pressures—Relation of Velocity Pressure to Velocity—Bernouilli's Theorem—Nature of Fluid Flow—Critical Velocity—Reynolds' Dimensional Analysis—Reynolds Number—Critical Reynolds Number—Flow Always Turbulent in Exhaust Piping—Pipe Friction in Laminar and Turbulent States—Velocity Distribution—Flow of Mixtures	
2 EXHAUST HOODS	16
Hood Types—General Rules for Design of Hoods—Particulates—Dispersion of Dusts—Local Air Movements and Counteracting Velocities—Effectiveness of Suction Openings—Typical Hood Contours—Relation of Face Area to Velocity—Summary of Hood Face Characteristics—Effect of Hood Structure in Rear of Face—Flanged Hood Faces—Influence of Adjacent Planes—Hoods for the Capture of Coarse Particles—Hoods for Woodworking Machinery—Saw Hoods—Shaper Hoods—Planer Hoods—Sander Hoods—Hoods for Metalworking Abrasive Processes—Hoods for Hand Tools	
3 ENCLOSURES, SIDE AND CANOPY HOODS	38
Complete Enclosure—Booth or Tunnel—Side Hood—Downdraft Hood—Canopy Hood—Hood Selection—Hoods for Material Handling—Hoods for Bench Operations—Hoods for Melting Furnaces—Hoods for Surface Treatment Operations—Dilution Ventilation	
4 AIR FLOW THROUGH HOODS	53
Air Velocities Required at Dust Sources—Exploring Hoods—Hood Face Velocities—Usual Exhaust Volumes for Typical Operations—Air Volume	

Entering Hood—Coefficient of Entry—Typical Orifices and Nozzles—Static Pressures at a Suction Opening—Effect of Suppressed Contraction—Entry Coefficients of Hoods—Synthetic Entry Coefficients—Entry Coefficients of Typical Hoods—Typical Flow Calculations—Flow Calculations—Economical Hood Design

5 PIPE RESISTANCE 80

Conveying Velocity—Special Considerations—Friction Loss in Round Pipes—Friction Loss in Rectangular Pipes—Friction Loss of Mixtures—“Velocity Head Rule” for Pipe Friction—Friction Loss in Hose—Losses in Elbows—Influence of Aspect Ratio—Influence of Angle of Turn—Influence of Approach Velocity—Compound Elbows—Venturi Elbows—Enlargements—Losses in Abrupt Enlargements—Losses in Tapers—Losses in Contractions—Losses in Tees—Losses in Breechings—Vacuum Booster—Losses in Transformers—Weather Protection

6 PIPING DESIGN 101

Outline of Piping Design Procedure—Necessity for Systematic Calculation—Data Sheets—Blast Gates and Floor Sweeps—Calculation of Typical Exhaust Systems—Design of a Woodworking System—Balancing the System—The System Characteristic Curve—Influence of Density Changes—Design of System for Process Material—Reduction of Fire and Explosion Hazard—Make-up Air—Checking Design of Purchased Systems

7 COLLECTORS 119

The Collector as an Air Pollution Control Tool—Preferred Characteristics of Air-cleaning Plants—Cleaning Efficiency—Recirculation of Exhaust Air—Location of Cleaned Air Discharge—Size Properties and Settling Rates of Dusts—Mechanics of Separation—Types of Particulate Collectors—Characteristics of Particulate Collectors—Gravity Chambers—Miscellaneous Traps—Hood Traps—Vortical Flow through Cyclone—Factors Affecting Separation—Separation Coefficient of Cyclones—Angular Travel During Separation—Field of Application of Large Diameter Cyclone—Pressure-drop through Cyclones—Low-loss Cyclones—High Efficiency Cyclones—Intermediate Diameter Cyclones—Small Diameter Cyclones—Cyclone Air Outlets—Factors Affecting Separation Efficiency—Dust Bins—Axial Flow Separators—Inertial Separators—Wet Particulate Collectors—High-temperature Gas Cleaning—Chemical Additives—Fabric Collectors—Principle of Operation—Pressure-drop Relationships—Dust-cake Removal—Mechanical Shaker—Application for Fabric Arresters—Electrostatic Precipitators—Plate Type—Tube Type—Control of Gaseous Emissions—Dilution—Wet Scrubbers—Absorption—Incineration—Individual Exhaust Units

8	LOW-PRESSURE CONVEYORS	170
	Conveying Velocities—Air Volume per Pound of Conveyed Solids— Suction versus Pressure Systems—Unloading and Feeding Devices—Venturi Tube Theory—Typical All-pressure Conveying System—Tandem Fans—Double Fans in Tandem—Belt-driven Fans—Economical Pipe Sizes—Relay Systems—Special Considerations for Conveying and Relay Systems	
	CENTRIFUGAL EXHAUST FANS	184
	Analysis of System Pressures—Fan Rating Pressures—Inlet and Outlet Connections—Power Consumption—Effect of Air Density on Power Consumption—Heat of Compression—High Temperature Operation—Performance Curves of Centrifugal Exhausters—Effect of Speed on Fan Characteristics—Effect of Size on Fan Performance—Effect of Direction of Rotation—Fan Types—Material Handling Fans—Wheel Types—Fans for Gaseous Materials—Special Fans—Fan Drives—Noise and Vibration—Ejector Systems—Dust-separating Fans	
10	AXIAL FLOW FANS	201
	Propeller Fans—Tubeaxial Fans—Vaneaxial Fans—Direction of Flow—Representative Installations—Fan Characteristics—Sound Level—Axial Flow versus Centrifugal Fans	
	STRUCTURAL DETAILS AND SYSTEM PLANNING	210
	Tapers—Elbows—Tees—Equalizers—Blast Gates—Ball and Telescope or Slip Joints—Cleanouts—Back Pressures Dampers—Switches—Weather Caps—Pipe Supports—System Size—Overhead, Floor Level, and Under-floor Piping—System Arrangement—Structural Details and System Planning	
12	FIELD MEASUREMENTS AND THEIR INTERPRETATION	222
	Manometers—The Impact Tube—The Pitot Tube—Anemometers—Location of Static Pressure Holes—Pitot and Impact Tube Traverses—Preferred Location of Pitot Tube Traverse—Static Pressure Holes in Pipe Walls—Estimating the Volume Rate of Flow—Testing Facilities for Measuring Hood Coefficients—Flow Direction Finder—Tests to Establish Conveying Velocities—Test to Check Design Assumptions—Tests of Systems for Maintenance Purposes—Locating and Diagnosing Trouble—Power Requirements of System Elements—Power Reduction	
	INDEX	239