Contents

. Introduction	
Growth of pollution	3
Control of pollution	4
Scope of the book	5
2. Origin of Fuel	6
Energy and the origin of the Earth	6
Fossil fuels	7
Energy value of fuels	8
Calorific value	8
Gross and net calorific value	10 11
World reserves and annual output	
3. Natural Solid Fuels	14
Wood	14
Wood charcoal	15
Peat	16
The coal series	16
Lignite	18
Bituminous coal	18
Ash and sulphur in coal	19
Washed coal	20
Coal hazards	21
4. Mineral Oils and Gases	23
Petroleum	23
The refining process	24
Characteristics of fuel oils	28
Preparation for burning: burners	30
Vaporizing burners	30
Pressure jet burners	30
Natural gas	33
5. Manufactured Fuels	34
History	34
Coke Coal tar and tar oils	35 38
Hydrogenation and hydrogarbon synthesis	38

viii Contents

Liquefaction and gasification	39
Alcohol	39
Manufactured gaseous fuels	40
Historical note	A7
6. Combustion and Power Generation	44
Internal combustion engine	47
Atmospheric pollution from engines	48
Cooling towers	50
Electricity	51
Uses of electricity	53
Conclusion	56
7. Industrial Boilers	57
Coal-fired boilers	57
Vertical boiler	58
Lancashire boiler	59
Economic boiler	60
Thermal storage boiler	61
Water-tube boilers	62
Industrial hot water boilers	64
Boiler instruments	67
Carbon dioxide	69
Smoke as an index of efficiency	71
Alternatives to coal	72
Mechanical stokers	73
Pulverized fuel	76
Boiler availability	78
Soot blowing	79
Fluidized beds	79
8. Industrial Furnaces	80
Group (1) furnaces	81
Horizontal retorts	82
Coke ovens	83
Vertical retorts	84
Static vertical retorts	85
Electric furnaces	85
Oil refineries	85
Group (2) furnaces	86
Atmospheric pollution from furnaces in Groups (1) and (2)	88
Group (3) furnaces	90
Steel industry	90
Clay industries	90
Lime and cement kilns	92
Atmospheric pollution from furnaces in Group (3)	94
Smoke in the steel industry	94
Sulphur dioxide and grit	94
Summary	95
9. Domestic Heat Services	96
Choosing a domestic heating system	97
Solid fuel	98
Central heating	100

	Contents	ix
	Gas and electric fires	102
	Thermal storage electric heating	102
	Thermal insulation	102
	Hot water and cooking	104 106
	Coal economy	100
10.	Atmospheric Pollution	108
	Smoke	109
	Ash	110
	Sulphur dioxide	111
	Carbon monoxide and carbon dioxide	112
	Nitrogen oxides (NO _x)	113 113
	Lead, chlorine and fluorine compounds Pollution from petroleum products	114
	Odours	115
	Radioactive air pollutants	115
	Pollution from other sources	117
	Gases from chemical works	117
	Burning spoilbanks	119 120
	Incineration of refuse	120
	The offensive trades Particles	121
#1	Measurement of Atmospheric Pollution	123
11.	Measurement of smoke	124
	Smoke filter	126
	Self-ch anging smoke filters	128
	Portable smoke filters	128
	Weighable smoke filter	129
	Measurement of ash and other deposited pollution	130
	Deposit gauge	130 133
	Rapid surveys of deposited matter Measurement of sulphur dioxide	135
	Volumetric estimation of sulphur dioxide	136
	Portable instruments for sulphur dioxide	137
	Automatic monitoring	137
	Sulphur dioxide by the lead dioxide instrument	138 140
	Pollution roses	140
	Microscopic examination of grit Microscopic examination of suspended matter	142
	Other pollutants	145
	Measurement of daylight	146
	Use of measurements of atmospheric pollution	146
12	Distribution of Pollution	
12.		4.45
	Historical perspective	147 147
	Distribution in Britain as a whole Deposited matter	147
	Depositea matter Smoke and sulphur dioxide	150
	Distribution within a town	153
	Deposited matter	153
	Smoke and sulphur dioxide	153
	Pacent curveus	1 57

× Contents

	The National Survey of Air Pollution	160
	Smoke	160
	Sulphur dioxide	160
	Concluding remarks	161
13.	Variability of Pollution	
		162
	Changes in deposited matter Yearly cycle	164
	Changes in smoke and sulphur dioxide	165
	Irregular variation	165
	Air pollution meteorology	169
	Chimney plumes	169 171
	Fogs	171
	Constituents of the London fog, December 1952	172
	Quantities	174
	Heat balance	175
	Water balance	175
	Smoke balance	176
	Sulphur balance	176
	Halogens	177
	Oxides of carbon	177
	Ground level concentrations	177
	Summary	180
14.	Effects of Pollution	181
	Biological effects	181
	Health	181
	Threshold limit values	184
	Smog disasters	184
	Mortality attributed to smog	185
	Effects on animals	188
	Effects on vegetation	188
	Physico-chemical effects	189
	Insulators	189
	Metals	189
	Materials	189
	Fog, visibility and sunlight	191
	The cost of pollution Conclusion	192 193
15.	Prevention of Atmospheric Pollution	194
	Prevention of smoke	194
	Prevention of ash and grit	195
	Selection of fuel	196
	Design and operation of furnace	196
	Particulate removal	197
	Air conditioning	201
	Prevention of sulphur dioxide	201
	Removal of sulphur from fuel	202
	Removing of sulphur dioxide from flue gases	203
	Chimney height	204

Contents	хi
16. Air Pollution Control—Law and Administration	207
The United Kingdom system	207
The Alkali Inspectorate—structure and responsibilities	208
Local Government administration and control	209
The Clean Air Acts	209
Smoke emissions	210
The control of chimney heights	211
Grit and dust from furnaces	212
Smoke-control areas	213
Air pollution legislation throughout the world	214
Air pollution control within the member states of the European Economic Community	214
Belgium	214
Denmark	215
France	215
Federal Republic of Germany	215
Ireland	216
Italy	216
Luxembourg	216
Netherlands	216
United States of America	217
Motor vehicle pollution	218
Appendix A. Conversions	220
Appendix B. British Standards	222
Bibliography	223
INDEX	227