CONTENTS

	Page
Chapter 1 INTRODUCTORY SURVEY OF LUBRICATION AND WEAR	
General division of the subject	1
Boundary lubrication	1
Fluid-film lubrication	2
Solid-film lubrication	3 3
Wear	3
Experimental studies of boundary and extreme-pressure lubricants	3
Boundary lubrication	3
Fluid-film lubrication	7
Theories of dry and lubricated sliding	8
Lubrication with a metallic film	10
Surface asperities and the laws of friction	12
Development of asperity welding theory Junction growth	14
The energy of plastic deformation of junctions	17
The contribution of shearing within the lubricant	19
Surface temperatures	19
Theory of fluid-film lubrication	21
The basic differential equation of hydrodynamic lubrication	21
The use of non-dimensional parameters in bearing theory	25
General features of journal bearing design	27
Thrust bearings	28
Externally-pressurised bearings	29
Air bearings	31
Hydrodynamic lubrication in metalworking	32
Elastohydrodynamic theory	32
Plastohydrodynamic theory	34
Magnetohydrodynamics	36
Friction in free rolling	37
Solid-film lubricants	38
Wear	40
The range of wear conditions	40
Wear-test apparatus	42
Methods of measuring wear, and of surface preparation for wear	
Studies	45
Results of wear tests	48
Analytical treatments of wear	58
References	62
Chapter 2 SOLID LUBRICANTS	
Introduction	67
Structure and properties of graphite and molybdenum disulphide	72
Mechanism of lubrication by lamellar solids	78
Theoretical mechanism	78
Experimental data	79
Conclusions	101
Lubrication by oxide films	103
Application of solid lubricants	105
Industrial uses of solid lubricant dispersions	115
Acknowledgement	
References	116 116

Chapter 3	CHEMICAL ADDITIVES	119
-	Introduction	119
	Additive types	120
	Additive application	120
	Crankcase lubricants	120
	Extreme-pressure lubricants	133
	Corrosion inhibitors	138
	Additive application	139
	Engine crankcase oils	140
	Modurn motor oils	147
	Automotive diesel lubricants	147
	Naval oils	149
	Lubricants for marine diesel engines	149
	Oils for railway diesel engines	150
	Two-stroke oils Gear lubricants	151 152
	Automatic transmission fluids	154
	Fluids for agricultural machinery	154
	Turbine and hydraulic oils	158
	Extreme-pressure turbine oils	160
	Fire-resistant hydraulic fluids	161
The future	The resistant ny draune ridias	164
References		164
Chapter 4	SYSTHETIC LUBRICANTS	
	Introduction	166
	Lubricating properties	170
	Principal classes of synthetic lubricants	181
	References	196
Chapter 5	LUBRICATING GREASES	
Chapter c	Definition and nature	197
	Composition and characteristics of typical greases	208
	Development of greases formulations and evaluation	228
	Manufacture and quality control	240
	Selection for service	261
	Acknowledgement	266
	References	266
CI 4	THE DICATION IN METAL CHIPPING	
Chapter 6	LUBRICATION IN METAL CUTTING	
	Introduction	260
	Introduction Broad classification of conditions of use for cutting fluids	269 270
	Broad classification of conditions of use for cutting fluids	270
	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types	270 275
	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies	270 275 289
	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection	270 275
	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces,	270 275 289 300
	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection	270 275 289
	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication	270 275 289 300
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS	270 275 289 300 301 308
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction	270 275 289 300 301 308
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties	270 275 289 300 301 308
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties Tin-base alloys	270 275 289 300 301 308 310 316 323
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties Tin-base alloys Lead-base alloys	270 275 289 300 301 308 310 316 323 343
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties Tin-base alloys Lead-base alloys Copper-base alloys	270 275 289 300 301 308 310 316 323 343 348
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties Tin-base alloys Lead-base alloys Copper-base alloys Aluminium-base alloys	270 275 289 300 301 308 310 316 323 343 348 354
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties Tin-base alloys Lead-base alloys Copper-base alloys Aluminium-base alloys Performance and evaluation of bearing materials	270 275 289 300 301 308 310 316 323 343 348 354 358
Chapter 7	Broad classification of conditions of use for cutting fluids Lubricant characteristics and types Experimental studies General conclusions and principles of selection Theories relating machining characteristics to rake-face forces, fiction and lubrication References METALLIC BEARING MATERIALS Introduction Metallic properties Tin-base alloys Lead-base alloys Copper-base alloys Aluminium-base alloys	270 275 289 300 301 308 310 316 323 343 348 354

Chapter 8	PLASTIC-BASED BEARINGS	
	Introduction	377
	Assessing bearing performance	380
	Bearings based on thermosetting resins	385
	Bearings based on thermoplastics	401
	Bearings based on PTFE	412
	Further development	423
	References	424
Chapter 9	AUTOMOTIVE LUBRICATION	
	The reciprocating engine	427
	The gas turbine	438
	The rotary engine	439
	Bearings and their lubrication in the piston engine	441
	Gears	460
	Engine oil filters	463
	"Running-in" of new engines	469
	References	471
Chapter 10	LUBRICATION IN METAL-WORKING	
	Introduction	472
	General aspects of lubrication in metal-working	474
	The assessment of lubricants for metal-working	485
	Lubricants for specific working operations	500
	References	509
	Author Index	555
	Subject Index	563