Contents

Preface to the 6th edition ---- V

1	Stage equipment, construction types and application criteria —— 1
1.1	Historical development —— 1
1.2	Tasks of technical stage equipment —— 5
1.3	Space concepts —— 6
1.4	Stage systems —— 12
1.5	Transport and storage systems —— 25
1.6	Design of multipurpose rooms and halls —— 36
1.7	Technical equipment of the lower stage – understage equipment —— 54
1.7.1	Lifting platforms —— 54
1.7.2	Stage wagons —— 109
1.7.3	Turntables and rotating platforms —— 122
1.7.4	Mobile podiums and stands —— 135
1.8	Technical equipment of the upper stage – upper stage equipment —— 141
1.8.1	Fixed installations in the upper stage —— 143
1.8.2	Proscenium facilities —— 148
1.8.3	Hoists with ropes —— 157
1.8.4	Hoists with chains —— 191
1.8.5	Hoists with steel belts —— 192
1.8.6	Special installations for limitation of the stage space —— 193
1.8.7	Mechanical equipment for lighting technology —— 199
1.8.8	Performer flying devices —— 203
1.9	Safety equipment for fire protection —— 207
1.9.1	Fire protection curtains —— 208
1.9.2	Smoke escape systems —— 213
1.9.3	Water extinguishing systems —— 215
2	Drives for stage equipment —— 220
2.1	Manual drives —— 220
2.2	Electric drives —— 221
2.2.1	Direct current drives and three-phase drives of classic design —— 221
2.2.2	Servo motor technology —— 231
2.2.3	Linear motor technology —— 232
2.3	Hydraulic drives —— 233
2.3.1	Components and their circuit symbols —— 233
2.3.2	Possibilities to change the working speed —— 245
2.4	Hydrostatic drives compared to electric drives —— 249
2.5	Operating the stage drives —— 253
2.5.1	Basic types of control —— 253



2.5.2	Requirements for the conception of operation —— 254
2.5.3	Organization of control stations —— 259
2.5.4	Operating modes for group travel —— 260
2.5.5	Emergency control options —— 262
2.5.6	C·A·T control system by Waagner-Biró Stage Systems —— 262
2.5.7	COSTACOwin – control system of the company SBS —— 281
2.5.8	SYB 3.0 control technology from Bosch Rexroth —— 288
3	Fundamentals of mechanics (mechanics of solid bodies and fluid
	mechanics) —— 296
3.1	The International System of Units —— 296
3.2	Fundamental terms of kinematics —— 297
3.2.1	Translation —— 298
3.2.2	Rotation —— 300
3.3	Fundamental terms of dynamics —— 302
3.3.1	Kinetic energy – energy of motion —— 303
3.3.2	Potential energy – energy of the position —— 303
3.3.3	Braking work —— 304
3.3.4	Application examples —— 304
3.3.5	Summary of the most important formulas —— 307
3.3.6	Multimass systems —— 309
3.4	Friction —— 310
3.4.1	Types of friction —— 310
3.4.2	Adhesion condition —— 313
3.5	Efficiency —— 314
3.6	Calculation of power requirement —— 316
3.6.1	Movement resistance in the steady state (without acceleration) —— 316
3.6.2	Movement resistance during acceleration —— 318
3.6.3	Drive power —— 318
3.7	Elastic components —— 320
3.8	Fundamental terms of hydraulics —— 322
3.8.1	Basic terms —— 322
3.8.2	Hydrostatic devices with linear and rotary work function —— 324
3.8.3	Hydraulic accumulator system —— 328
3.8.4	Piping —— 330
3.9	Hydraulic fluids —— 330
3.10	Vibrations —— 336
3.10.1	Single-mass oscillator —— 338
3.10.2	Oscillating continuum —— 347
3.10.3	Vibration excitation —— 351
3.10.4	Perception of vibrations —— 352
3.11	Acoustics —— 353

3.11.1	Sound and hearing sensation —— 353
3.11.2	Sound field parameters —— 356
3.11.3	Measures for noise reduction —— 364
3.11.4	Measures to influence the room acoustics —— 365
4	Project planning and design information on stage equipment
	components — 366
4.1	Ropes and rope drives —— 366
4.1.1	Wire ropes, rope sheaves and rope drums —— 366
4.1.2	Block and tackle systems —— 373
4.1.3	Winch drive —— 376
4.1.4	Traction sheave drive —— 376
4.1.5	Clamping drive —— 380
4.1.6	Fiber ropes —— 380
4.2	Chains and chain drives —— 381
4.2.1	Chains —— 382
4.2.2	Chain drive —— 388
4.3	Wedge and spindle drive —— 390
4.3.1	Wedge drive —— 390
4.3.2	Spindle drive —— 393
4.4	Gear drives —— 396
4.4.1	Toothing —— 396
4.4.2	Gearbox —— 400
4.5	Cardan shafts —— 401
4.6	Special low-friction bearings —— 404
4.6.1	Hydrostatic bearing —— 405
4.6.2	Air cushion technique —— 405
4.7	Brakes —— 408
4.8	Notes on the standard-compliant dimensioning of hoists —— 414
4.8.1	Required verifications according to standard —— 414
4.8.2	Computational investigation of the system behavior in the event of a
	fault —— 415
4.8.3	Supplementary notes —— 423
4.8.4	Findings from the investigations —— 424
4.8.5	The load limiter from Bosch Rexroth —— 427
4.9	Trusses and truss systems for rigging purposes —— 428
5	Safety regulations – standards —— 432
5.1	Hazards to stage personnel and performers —— 432
5.2	Hazards for the spectators —— 439
	•

Index —— 441