

CONTENTS.

PART I.

STATICS.

The Parallelogram of Pressures

The Polygon of Pressures

The Principle of the Equality of Moments

The Parallelopipedon of Press	ures -	-	-	-	16
Of Parallel Pressures -	-	-	-	-	18
The Centre of Gravity -	-	-	-	-	23
	PART II.				
		="			
	DYNAMICS	•			
Work	•	•	-	-	53
Work of Pressures applied in	different Di	rections t	o a Body m	ove-	
able about a fixed Axis	-	-	-	-	65
The Moment of Inertia -	-	-	-	-	81
THE ACCELERATION OF MOTI	ON BY GIVE	N MOVING	Forces	-	91
The Descent of a Body upon a	a Curve	-	-	-	95
The Simple Pendulum -	-	-	-	-	97
Impulsive Force -	-	-	•	-	98
The Parallelogram of Motion	-	-	-	-	99
The Polygon of Motion -	-	-	•	-	100
The Principle of D'Alembert	•	-	-	-	101
Motion of Translation -	-	-	**	-	103
Motion of Rotation about a fix	ked Axis	-	-	-	104
The Centre of Percussion	-	-	-	-	109
The Centre of Oscillation	-	-	-	-	110
Projectiles	-	-	-	-	113
Centrifugal Force -	-	-	•	-	121
The Principle of virtual Veloc	ities -	-	-	-	128
The Principle of Vis Viva	-	-	-	-	131
FRICTION	-	-	-	-	137
Summary of the Laws of Frict	ion -	-	•	-	144
•	a 2				

Page

3

7

11



$\mathbf{x}\mathbf{x}$ CONTENTS. Page 145 The limiting Angle of Resistance -147 The Cone of Resistance The two States bordering upon Motion 148 - 156 THE RIGIDITY OF CORDS PART III. THE THEORY OF MACHINES. 160 The Transmission of Work by Machines The Modulus of a Machine moving with a uniform or periodical Motion - -162 The Modulus of a Machine moving with an accelerated or a retarded 164 The Velocity of a Machine moving with a variable Motion 166 To determine the Co-efficients of the Modulus of a Machine 167 General Condition of the State bordering upon Motion in a Body acted upon by Pressures in the same Plane, and moveable about a cylindrical Axis 169 The Wheel and Axle 170 The Pulley 175 System of one fixed and one moveable Pulley 176 A System of one fixed and any Number of moveable Pulleys 178 A Tackle of any Number of Sheaves 181 The Modulus of a compound Machine 185 The Capstan -211 The Chinese Capstan 217 The Horse Capstan, or the Whim Gin 220 The Friction of Cords - -224 The Friction Break - 230 The Band - 233 The Modulus of the Band The Teeth of Wheels - 235 - 245 Involute Teeth - 253 Epicycloidal and Hypocycloidal Teeth - 255 To set out the Teeth of Wheels -- 259 The Teeth of a Rack and Pinion -- 275 The driving and working Pressures on Spur Wheels - 281 The Modulus of a System of two Spur Wheels - 291 The Modulus of a Rack and Pinion - 305 Conical or Bevil Wheels - 306 The Modulus of a System of two Bevil Wheels - 312 The Modulus of a Train of Wheels -- 324 The Train of least Resistance - 333



CONTENTS.					xxi
m					Page
The Inclined Plane	-	•	•	-	337
The Wedge driven by Pr		-	-		345
The Wedge driven by In	ipact	-	-		347
The Screw -	-	-	-		351
Applications of the Scre	W	•	•		354
The Differential Screw	-	•	•		356
Hunter's Screw	-	-	•		35 8
The Theory of the Scre variable Inclination of					
Axis -	-	•	-		359
The Beam of the Steam	Engine	-	-	-	363
The Crank -	•	-	-		367
The Dead Points in the	Crank	-	-	-	٠.,
The Double Crank	-	-	-	-	372
The Crank Guide	-	-	-		377
The Fly-wheel	-	-	-	-	379
The Friction of the Fly-		•	-	-	388
The Modulus of the Cra	nk and Fl	y-wheel	-		000
The Governor	•	-	-	-	000
The Carriage-wheel	•	-			394
	PA	RT IV.			
THE THEORY			Y OF STR	UCTURES.	
General Conditions of t	he Stabili	tv of a Sti	ructure of	Uncemented	
Stones -		-	-		403
The Line of Resistance		-	-		403
The Line of Pressure		-			405
The Stability of a Solid I	Bodv				407
The Stability of a Struct		_	_		408
The Wall or Pier	-	_	-		409
The Line of Resistance i	n a Pier	-	-		410
The Stability of a Wall s		by Shores	-		414
The Gothic Buttress	-	•			422
The Stability of Walls su	staining F	Roofs	_		424
The Plate Bande	_	-	-		429
The Stability of Wall sus	taining th	e Pressure	of Water		436
Earth Works		•	•		440
Revetement Walls	-	_			445
The Arch -	_	_			458
The Angle of Rupture		_	_		467
The Line of Resistance	in a cir	cular Arch	whose V	oussoirs are	
equal, and whose Load					
Extrados -	-	-			470



xxii	CON	TENTS.				
A segmental Arch whose Ex	trados	is horizo	ntal	_	_	Page
A Gothic Arch, the Extrado Line inclined at any given	s of e	each Semi le to the	-Arch bei Horizon,	and the M		
terial of the Loading differ					-	472
A circular Arch having equal	Vous	soirs and	sustaining	the Pressi	ıre	
of Water		-	-	•	-	473
The Equilibrium of an Arcl geometrically accurate	n, the	Contact	of whose	Voussoirs	is -	476
Applications of the Theory o	f the	Arch	-			478
Tables of the Thrust of Arch		•	-	-	-	484
	PA	RT V.				
THE STR	ENGT	H OF MA	ATERIALS	S.		
Elasticity		-	-	-	-	486
Elongation		-	-	-	-	488
The Moduli of Resilience and	l Frag	ility	-	•	•	491
Deflexion	_	-	-	-	-	496
The Deflexion of Beams load	ed uni	iformly	-	-	-	511
The Deflexion of Breast Sun	mers	•	-	-	-	516
Rupture		_	-	-	-	533
Tenacity		-	-	-	-	533
The Suspension Bridge -		-	_	-	-	536
The Catenary -		-	-	-	-	537
Rupture by Compression		-	-	-	-	549
The Section of Rupture in a	Beam		_	-	_	552
General Conditions of the Ru			m	_	-	552
The Beam of greatest Streng		•		-	_	566
The Strength of Breast Sumi		_	_		_	573
The best Positions of their P		of Suppor	•t		_	575
Formulæ representing the ab				drical Colum	nn	
to sustain a Pressure in th				-	-	578
Torsion	C DIIC	-	-	-	-	580
	PAF	RT VI.				
	IM	PACT.				
The Pile Driver -		-	-	_		500

- 598



CONTENTS. XXIII

APPENDIX.

							Page
Note A.	-	-	-	-	-	-	605
Note B. —	Poncelet's 7	Cheorem	-	-	-	-	606
Note C.	-	-	-	-	-	-	611
Note D	The best Di	imensions	of a Bu	ttress	-	-	611
Note E	Dimensions	of the Te	eth of \	Wheels	-	-	612
Note F	Experiment	s of M. M	forin on	the Tractio	on of Carr	iages	613
Note G	On the Stre	ngth of C	olumns	-	-	-	614
Table I. —	The Numer	ical Value	s of con	nplete Ellip	tic Functi	ons of	
the first	and second	Orders fo	r Value	s of the M	odulus k	corre-	
sponding	to each Deg	ree of the	Angle	sinik	-	-	615
Table II.	Showing th	he Angle	of Rup	ture Ψ of	an Arch	whose	
Loading i	is of the sa	ame Mater	rial with	its Vousse	oirs, and	whose	
Extrados	is inclined a	at a given	Angle t	to the Hori	zon -	-	616
Table III	- Showing	the Ho	rizontal	Thrust of	an Arch	, the	
Radius of	whose Intr	ados is U	nits, and	l the Weigh	t of each	Cubic	
Foot of it	s Material a	nd that o	f its Lo	ading, Unit	у -	-	619
Table IV	- Mechanica	d Properti	ies of t	he Material	s of Con	struc-	
tion	-	- '	•	-	-	-	622
Table V	Useful Nur	nbers	-	•	-	-	626