

LOCOMOTIVE OPERATION

A TECHNICAL AND PRACTICAL
ANALYSIS

BY

G. R. HENDERSON

MEMBER AMERICAN SOCIETY MECHANICAL ENGINEERS

SECOND EDITION

CHICAGO
THE WILSON COMPANY
1907

TABLE OF CONTENTS.

CHAPTER I.

	PAGE
INERTIA	1
Starting and Stopping.....	2
Centrifugal Force on Curves.....	10
Effect on Rods.....	19
Reciprocating Parts	26
Counterbalance	41

CHAPTER II.

STEAM ACTION	75
Steam Chest Pressure	78
Valve Motion	81
Steam Distribution	102
Compression	121
Work of Steam	128
Quantity of Steam	137
Rotative Force	146
Strains Induced	162
Piston Rods	165
Guides	171
Rods	176
Crank Pins	183
Driving Axles	187
Drifting	196

CHAPTER III.

RESISTANCE	203
Rail Friction or Adhesion	204
Tire Wear	207
Rolling Friction	216
Journal Friction	217
Pin Bearings	228
Guide Friction	230
Stuffing Box Friction	232
Cylinder Friction	233
Valve Friction	236

	PAGE
Link Motion Friction	241
Internal Resistance	242
Brake Shoe Friction	245
Center Plate and Side Bearing Friction.....	253
Train Resistance	257
Journal Resistance	258
Wind Resistance	259
Miscellaneous Resistances	262
Speed Resistance	263
Inertia Resistance	265
Grade Resistance.....	266
Curve Resistance	268
Resistance Affected by Loading	270
Resistance Affected by Weather	274
CHAPTER IV.	
SLIPPING	276
Traction Increases	285
CHAPTER V.	
BRAKING	293
Retardation by Brakes	309
Arrangement of Brakes	319
Power Consumed	333
Cylinder Brakes	335
CHAPTER VI.	
STEAM CAPACITY	344
Heating Surface	345
Grate Area	349
Draft Action	354
Maximum Horsepower	357
CHAPTER VII.	
HAULING CAPACITY	364
Tractive Force at Slow Speed.....	364
Tractive Force at High Speed.....	375
Tractive Force at Variable Speed.....	384
Locomotive Rating	388
Rating of Slow Freights.....	390
Rating of Fast Freights.....	398
Rating for Momentum Runs.....	401
Starting and Stopping.....	410
Horsepower Characteristics	416

TABLE OF CONTENTS.

ix

CHAPTER VIII.

	PAGE
WATER CONSUMPTION	422
Maximum Quantity of Water.....	422
Intermediate Quantities of Water.....	426
Water per Horsepower Hour.....	428
Quantity of Water Affected by Pressure.....	430
Superheating	432
Waste of Water	437
Water Scoops	439
Quality of Water	442
Treatment of Water	446
Care of Boilers.....	451

CHAPTER IX.

FUEL CONSUMPTION	455
Composition of Fuels	455
Combustion	458
Thermal Value of Fuel.....	466
Evaporation	470
Quantity of Coal Used	476
Effect of Load and Speed	482
Waste of Fuel	488
Oil Burning	494
Burners	496
Arrangement	497
Operation	498
Advantages and Disadvantages	499