

**A NEW TREATISE ON STEAM
ENGINEERING, PHYSICAL
PROPERTIES OF PERMANENT
GASES, AND OF DIFFERENT
KINDS OF VAPOR**

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A new treatise on steam engineering, physical properties of permanent gases, and of different kinds of vapor by John W. Nystrom

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JOHN W. NYSTROM

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BY
JOHN W. NYSTROM, C. E.

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PREFACE.

THE object of this treatise is to furnish a variety of matters pertaining to STEAM ENGINEERING which appear to be wanting in that profession, and which have heretofore not been published.

The authors consulted for this work are eminent experimenters, such as Regnault and Rudberg on steam and gases, Faraday, Pelouze and Andrews on carbonic acid, Favre and Silberman on heat of combustion, Kopp on volume of water, Fairbairn and Tate on volume of steam. None of these savans, however, are responsible for the formulas and tables herein deduced from their experiments.

Where physical sciences are not sufficiently developed to establish a law of action mathematically, experiments are made for the purpose of guiding us to the law; but it can rarely ever be expected that experiments alone can give perfect results, but they give an approximation to the law of variation, which must finally be adjusted and established by the aid of mathematics. This is what has been attempted in the present work.

It was at first not intended to include in this work the steam-tables which are published in the author's *Pocket-Book*, but after having carefully investigated the Fairbairn experiments and formula for volume of steam and concluding that they could not be relied upon, it was therefore decided to calculate new steam-tables and extend them to a pressure of 1000 pounds to the square inch.

The relation between temperature and pressure of steam is also slightly altered in the new steam-tables so as to conform to a uniform curve or law, because the average curve adopted by Regnault does not follow a regular law, and therefore indicates that there must have been some inexactness in his experiments.

When the author worked out the first steam-table in the Navy Department under the direction of Chief-engineer Isherwood, the irregularity of the Regnault curve was then demonstrated with attempts

to correct it, but the Chief would not allow any deviation from that curve. The difference is, however, within probable experimental errors, and so small that it is not of much importance in practice.

The author believes that the relation between temperature, pressure and volume of steam, as given in these new tables, is nearest right. The old steam-tables are, however, referred to and used in the body of this work for the reason that many readers may have more faith in them than in the new tables, which are equally applicable to the examples.

Many mathematical proofs have been omitted in this work in order to avoid extensive algebraical demonstrations, which are objectionable to the general reader who only needs the resulting formulas for the insertion of his given numerical values.

The principal formulas are accompanied with examples and also tables ranging between practical limits, showing at a glance the relation between and proportion of the operating elements.

The calculus has been resorted to in only a few cases of necessity where the result could not otherwise be reached.

The numbers of the examples are arranged to correspond with the numbers of the formulas, and therefore do not run in order.

Profound and high-sounding terms, like "potential and kinetic energy," etc., are not used in this work, which limits itself to simple terms such as are used in the shop, and which express the true meaning of the respective cases.

The appendix on "Mechanical Terms" is added to this work to furnish an idea of the unsettled condition of that subject.

Similar discussions have been published in pamphlet form and distributed gratis to institutions of learning.

ALPHABETICAL INDEX.

A.	PAGE	C.	PAGE
Air, compression and expansion of	128	Carbonic acid, properties of	136
“ for combustion	51, 53	Cause of boiler explosions	86
“ quantity of, for draft	62	Chimneys, general properties of	42, 122
“ work of compression and expansion	132	“ correction for height of	41
Alcohol vapor, properties of	164	“ horse-power of	123
Ammonia vapor	166	Collapse, strength of flue for	106
Appendix	171	Combustion of coal per height of chimney	41
Aqueous vapor, properties of	139	Combustion, incomplete	47
Atmospheric pressure, horse-power of	27	“ heat of	46
Available heat of combustion	51, 53	“ power of	43
		“ products of	56
		“ properties of air for	45
B.		Colors for tempering steel	63
Benzine, vapor of	165	Condenser, fresh water	67
Boilers, explosions	82	Correction for temperature of feed-water	21
“ generating steam	18	Correction for height of chimney	41
“ horse-power by \equiv and \square	37, 40	Covering steam-pipes	81
“ inspector's rule for	89		
“ lap-joint, riveted	92 to 105	D.	
“ legal horse-power of	35	Distillation of petroleum	168
“ plates must be stamped	89	Destructive work of boiler explosions	85
“ standard efficiency of	52	Draft, velocity of, in chimneys	60-122
“ stays on flat surfaces	108		
“ strength and safety of	89-109	Draft, natural, in furnaces	59
Boiling point of different liquids	168	“ temperature of	45
Burning of smoke	57	“ quantity of air for	62

	PAGE		PAGE
Dryness or humidity of steam	143	Gases in chimney, velocity of	122
Dynamical terms	171	“ permanent	112
Dynamics, principles of	14	“ specific heat of	119
E.			
Economy of heating feed-water	54	Gauge, water, for draft	61
Elasticity of permanent gases	112	Grate-bars, spaces between	57
Ether, vapor of	165	H.	
Equivalent work of heat in steam	142	Heat, available by combustion	53
Equivalent of heat, dynamic	30	“ of combustion	46
Evaporation from and at 212°	53	“ in water and steam, units of	141
“ legal horse-power of	40	“ permanent gases	120
“ natural effect of	23	“ lost by radiation	78-82
“ per square foot of \square	66	“ lost through chimneys	63
Expansion and compression of air	129-133	“ physical constitution of	18
Explosion of steam-boilers	142	Height of chimneys	42, 123
F.			
Fairbairn and Tate, steam-volume	19-144	Horse-power of steam, natural of	20, 23
Feed-water, heating of	54	Horse-power of steam-boilers	32, 36
“ quantity of	76	Horse-power of boilers by \equiv and \square	37, 40
“ reduction for temperature	22	Horse-power of chimneys	42, 123
Feed-pump, capacity of	77	“ by volume of steam	74
Felt covering for steam-pipes	82	Humidity of steam	143
Fire, management of	55	Hyperbolic logarithms	29
Fire-grate, spaces between	57	I and J.	
Flues, strength of, for collapse	106	Inflammation of petroleum	168
Fresh water condenser	57	Inspectors for steam-boilers	89
Fuel, heat generated by	48	Joints, lap-, for riveted boilers	92-105
Fuel, properties of	50	K.	
Furnace draft, natural	59	Kabyl, French ether ship	164
G.			
Gases in chimney, temperature of	64	Kerosene	169
L.			
		Lap-joints, single and double riveted	92-105

	PAGE		PAGE
Latent heat in water and steam	139-141	Primary source of power	17
Laughing-gas	166	Products of combustion	56
Law of the United States, steam-boilers	89	Protoxide of nitrogen	168
Legal horse-power of steam-boilers	35-40	Prevention of boiler explosion	86
Letters, standard notation of	10	Q.	
Locomotive without fire	110	Quantity of steam escaping	72
Logarithms, hyperbolic	29	“ of feed-water	76
Loss of heat through chimneys	63	R.	
Loss of heat by radiation	78-82	Radiation of heat from pipes	78-82
M.		Reduction for temperature of feed-water	22
Mean pressure of steam	28, 160	Reduction for height of chimney	41
Mechanical terms	12	Revolutions and steam-pressure	74
Moisture in fuel	49	Riveted lap-joints	92-105
N.		S.	
Natural effect of full steam	19, 20	Safety-valves	71, 67
“ “ of expanded steam	26	Site for safety-valves	69
Natural effect of furnace draft	59	Smoke, burning of	57
Notation of letters, standard	10	Specific heat of gases	119
O.		Staying of boilers	108
Oils of petroleum	169	Steam engineering	17
Oxygen and hydrogen in fuel	49	“ engine <i>versus</i> water-wheel	17
P.		Steam, natural effect of	19
Petroleum as fuel	53	“ volume, Fairbairn's	19, 144
“ oils, properties of	168	“ boiler explosions	82
Permanent gases	112	“ boiler experiments	18
Plates for boilers to be stamped	89	“ expansion of	19, 24
Power of combustion	43	“ equivalent work of	19, 20
“ “ steam without fire	110	“ velocity through openings	70
“ lost by radiation	79	“ quantity escaping	72
		“ power without fire	110
		“ or aqueous vapor	139
		“ dryness or humidity of	143