INDEX

A. V. Roe Canada Ltd., turbojet, 15-67
Abbreviations, measures and weights, 20-45
Abradability of coal and coke, 2-23
ABS boiler construction rules, 7-17
Absolute pressure, 18-15
Absolute pressure gage, 18-17, 19-11
Absolute temperature, 3-03
Absorber, alkaline-type, in water treatment, 7-02
Absorption, alpha, 17-05
beta-ray, 17-05
Absorption band, resonance, 17-09
Absorption refrigeration, 11-29
Absorption refrigeration system, applications, 11-35
Absorptivity, various surfaces, 2-26
Ac-dc locomotives, 14-46 (see also alternating current entries)
A-c to d-c power conversion, 16-76, 16-83
Acceleration, dimensions, 5-05
piston, 14-70
Acceleration resistance, trains, 14-04
Accessories, aircraft engine, 13-44
Accessory equipment, refrigeration, 11-45
Accounting, depreciation, 16-92
Accuracy of thermocouples, 18-08
Acetylene, 2-84 (see also Gases)
combustion, 2-04
data, 1-40
Acidity of feedwater, 7-52
Actinium, nuclear properties, 17-19
Actions of controllers, 18-23
Acy1 blue, 7-53
Adhesion, locomotive, factor of, 14-08
Adiabatic frictionless flow of gases, 3-61
Adiabatic process, 3-53
Adiabatic saturation of air, 12-75
Admiralty coefficient, 15-71
Aerial electric cable, 16-73
Aerodynamics, 15-08
Aerodynamic heaters, performance (Table), 12-49
Aeronca Aircraft Corp., 15-05
Affinity relations, jet pump, 5-81
Aftercooler, steam-jet ejector, 9-17
Aftercoolers, compressor, 1-54
cooling water requirements, 1-56
gas turbine (def), 10-09
Agglomerating properties, coal (Table), 2-31
Agglomerating value, coal, 2-22
AIEE-ASME preferred standard turbines, 8-52
Ailerons, 15-23
Air, 1-01
adiabatic saturation, 12-75
atmospheric, composition, 3-54
Beattie-Bridgeman constants, 3-57
composition, 1-02, 2-03
compressed, 1-34
transmission, 1-54
critical-state properties, 3-80
density (Table), 5-03
density ratios at various altitudes and temperatures, 1-59
dry, 1-02
data, 3-03
total heat, 12-74
Air (continued)
entropy, 1-02
effect on CO2 in flue gas, 2-49
expansion, 3-09
flow, 1-10
in pipes, 1-22
free convection of, 3-18
gas constant R, 1-03
kinematic viscosity (Table), 5-03
Mach number-temperature-pressure data (Table), 3-06
mass density (Table), 5-03
modulus of elasticity (Table), 5-03
molar heat capacity (Table), 2-10
molecular weight, 1-03
partially saturated, total heat, 12-75
pressure drop in pipes (Table), 1-25
properties, 1-02, 1-40
properties at low temperatures, 1-03
saturated, 12-74
partial pressure (Table), 9-06
specific volume (Table), 9-06
total heat, 12-74
scavenging, 13-03
specific heat at high pressures and temperatures, 3-59
standard, in fan practice, 1-63
standard density, in fan practice, 1-79
standard specific weight at sea level, 15-06
temperature-entropy diagram, 1-03
temperature-ratio factor, X (Table), 15-45
theoretical, for combustion, 2-04
for various fuels (Table), 2-04
thermal conductivity, 3-16
transmission in pipes (Table), 1-31
velocity of sound in, 1-06
viscosity, 1-15, 5-03 (Table)
Air chambers for pumps, 5-73
Air-change method of heat loss calculation, 12-11
Air changes, room (Table), 12-11
Air compression, power for, 1-46
Air compressors, design data, 1-44
hydraulic, 1-50
Air conditioning, 12-02, 12-73
calculations for, 12-82
theater, 12-85
Air-cooled in-line aircraft engines, 13-42
Air-cooled refractory walls, 7-77
Air ducts, allowable velocity, 12-50
design, 12-50
Air filters, 12-73
Air flow in pipes, 6-44
Air heaters, 7-34, 7-40 (see also Air preheaters)
Air horsepower, fan, 1-80
Air jet velocities, 1-09
Air leakage, surface condenser, 9-15
Air-lift pump, 5-82
Air motion in ventilating, 12-73
Air preheaters, 7-30, 7-34
air temperatures, 7-37
cleaning, 7-38
continuous regenerative, 7-34
corrosion, 7-37
deposition, 7-38
INDEX

Air preheaters (continued)
economizers vs., 7-54
fuel saving by, 7-56
gas temperatures, 7-37
heat-transfer rates, 7-38
intermittent regenerative, 7-34
Ljungstrom regenerative, 7-40
minimum metal temperatures, 7-37
plate-type, 7-34, 7-40
pressure drop in, 7-38
recuperative, 7-54
regenerative, 7-54
Ljungstrom, 7-35
selection, 7-36
temperature control, 7-38
tubular, 7-35

Air pressure, conversion table, 1-09
Air properties at low pressure, 1-06
Air pump capacity, jet condenser, 9-19
Air rate, gas turbine, 10-11
Air removal equipment, condenser, 9-16
mechanical, 9-19
Air removal systems, design data, 9-19
Air required for combustion, 2-08
of butane, 2-60
of propane, 2-60
Air resistance, locomotive, 14-49
railroad equipment, 14-49
streamlined railroad equipment, 14-02
of trains, 14-02
Air spaces, conductivity, 11-37
insulating effect, 3-39
thermal conductance, 12-08
Air standard cycle, 13-06
Air-standard efficiency, engine (def), 13-45
Air tables, 1-04
Air transportation, 15-01, 15-83
Air velocities, theoretical, 1-09
for various velocity pressures, 1-79
Air vitiation, causes, 12-72
Air washers, 12-75
dehumidifying, 12-82
Air and water vapor, mixtures of 1-02, 1-06
saturated mixtures of, 1-07

Aircooled Motors, Inc., engines, 13-52
Aircraft, 15-02 (see also Airplanes)
directional stability, 15-23
forms, 15-02
heavier-than-air, 15-02
lateral stability, 15-23
lighter-than-air, 15-02
longitudinal stability, 15-22
pilotless, 15-02
stability, 15-22
tail surface area, 15-23
transport and personal (Table), 15-04

Aircraft engines (Table), 13-52
accessories, 13-44
air-cooled in-line, 13-42
Allison, data, 13-52
altitude performance, 13-48
American, data (Table), 13-52
bearings, 13-42
bore and stroke, 13-52
carburetion, 13-49
classification, 13-41
compounding of, 13-49
compression ratio, 13-52
connecting rods, 13-42
cooling, 13-51
crankcase, 13-42
crankshafts, 13-42
cruising power, 13-52
cruising speed, 13-52

cylinder construction, 13-48
detonation, 13-47
dimensions, 13-52
displacement, 13-52
effect of altitude on output, 13-47
effect of compression ratio on performance, 13-47
effect of mixture ratio on performance, 13-46
effect of spark advance on performance, 13-46
effect of speed on performance, 13-46
Franklin, data, 13-52
fuel injection, 13-49
horizontally opposed, 13-42
ignition systems, 13-48
Jacobs, data, 13-53
Lycoming, data, 13-53
materials, 13-42
mechanical arrangement, 13-41
mixture ratio, 13-46
noise, 13-51, 13-55
performance, 13-44
performance factors, 13-45
piston rings, 13-43
pistons, 13-43
Pratt and Whitney, data, 13-53
preignition, 13-47
radial, 13-42
Ranger, data, 13-54
sleeve-valve, 13-44
spark plugs, 13-49
stress determinations, 13-55
structural components, 13-42
supercharging, 13-49
take off power, 13-52
take-off speed, 13-52
thermodynamic characteristics, 13-41
valve mechanism, 13-43
valves, 13-43
Vee types, 13-42
vibration, 13-51
Warner, data, 13-54
Wright, data, 13-54
Aircraft fuels, 13-59-50
Aircraft gas turbines (Table), 15-66
compressors, 15-55
Aircraft materials, 15-03
Aircraft performance, effect of altitude, 15-17
Aircraft piston engines, 13-40
history, 13-40
Aircraft power plants, 15-18
Aircraft propellers, coefficients, 15-20
reduction gears, 13-44
Aircraft propulsion, general principles, 15-38
Aircraft structural analysis, 15-23
Aircraft structural materials, weights (Table), 15-05
Aircraft superchargers, 10-04
Airfoils, 15-07
center-of-pressure of, 15-09
center-of-pressure travel, 15-09
characteristic curves, 15-08
circular-arc, 15-33
compressible-flow, 15-10
double-wedge, 15-33
flat plate, 15-33
laminar-flow, 15-10
moment coefficient, 15-09
section characteristics, 15-11
selection, 15-10
shapes of supersonic, 15-33
Airplane power plants, speed ranges, 15-19
Airplane propellers, 15-20
Airplanes, amphibian, 15-03 (see also Aircraft)
<table>
<thead>
<tr>
<th>Index</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airplanes (continued)</td>
<td>3</td>
</tr>
<tr>
<td>Breguet's range formula, 15-18</td>
<td></td>
</tr>
<tr>
<td>canard type, 15-03</td>
<td></td>
</tr>
<tr>
<td>ceiling, 15-18</td>
<td></td>
</tr>
<tr>
<td>center of gravity, 15-22</td>
<td></td>
</tr>
<tr>
<td>classification, 15-02</td>
<td></td>
</tr>
<tr>
<td>cruising speed, 15-18</td>
<td></td>
</tr>
<tr>
<td>elements, 15-02</td>
<td></td>
</tr>
<tr>
<td>empennage, 15-03</td>
<td></td>
</tr>
<tr>
<td>interference drag, 15-16</td>
<td></td>
</tr>
<tr>
<td>Jato for, 15-03</td>
<td></td>
</tr>
<tr>
<td>landing gear, 15-03</td>
<td></td>
</tr>
<tr>
<td>maximum speed, 15-17</td>
<td></td>
</tr>
<tr>
<td>monocoque construction, 15-03</td>
<td></td>
</tr>
<tr>
<td>parasite drag, 15-16</td>
<td></td>
</tr>
<tr>
<td>performance analysis, 15-16</td>
<td></td>
</tr>
<tr>
<td>power for horizontal flight, 15-17</td>
<td></td>
</tr>
<tr>
<td>power loading, 15-18</td>
<td></td>
</tr>
<tr>
<td>power-plant arrangement, 15-03</td>
<td></td>
</tr>
<tr>
<td>range, 15-18</td>
<td></td>
</tr>
<tr>
<td>rate of climb, 15-18</td>
<td></td>
</tr>
<tr>
<td>structural design, 15-03</td>
<td></td>
</tr>
<tr>
<td>tail surfaces, 15-03</td>
<td></td>
</tr>
<tr>
<td>take-off, 15-03</td>
<td></td>
</tr>
<tr>
<td>transport and personal (data), 15-04, 15-05</td>
<td></td>
</tr>
<tr>
<td>tricycle gear, 15-03</td>
<td></td>
</tr>
<tr>
<td>wing loading, 15-17</td>
<td></td>
</tr>
<tr>
<td>Airships, 15-02</td>
<td></td>
</tr>
<tr>
<td>characteristics, 15-27</td>
<td></td>
</tr>
<tr>
<td>performance, 15-27</td>
<td></td>
</tr>
<tr>
<td>range, 15-27</td>
<td></td>
</tr>
<tr>
<td>rigid, characteristics (Table), 15-27</td>
<td></td>
</tr>
<tr>
<td>Airworthiness, 15-23</td>
<td></td>
</tr>
<tr>
<td>Alcohol, 2-59</td>
<td></td>
</tr>
<tr>
<td>critical-state properties, 3-00</td>
<td></td>
</tr>
<tr>
<td>isopropyl, 14-83</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-15</td>
<td></td>
</tr>
<tr>
<td>Alkalinity of feedwater, 7-52</td>
<td></td>
</tr>
<tr>
<td>All-American Aircraft, Inc., 15-05</td>
<td></td>
</tr>
<tr>
<td>Allison Division, General Motors Corp., turbojet units, 15-66</td>
<td></td>
</tr>
<tr>
<td>Allison engines, 13-52</td>
<td></td>
</tr>
<tr>
<td>Alloys, 10-35 (see also name of alloy) composition of high temperature (Table), 10-35</td>
<td></td>
</tr>
<tr>
<td>Inconel, 10-35 melting points (Table), 3-07</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-13</td>
<td></td>
</tr>
<tr>
<td>Timken, 10-35</td>
<td></td>
</tr>
<tr>
<td>Vitallium (cast), 10-35</td>
<td></td>
</tr>
<tr>
<td>Alternating-current locomotives, 14-46 (see also a-c engines)</td>
<td></td>
</tr>
<tr>
<td>Alternating-current power transmission, 18-04</td>
<td></td>
</tr>
<tr>
<td>Alternating-current ship propulsion, 15-78</td>
<td></td>
</tr>
<tr>
<td>Altitude, effect on aircraft engine output, 13-47 effect on aircraft performance, 15-17</td>
<td></td>
</tr>
<tr>
<td>effect on compressors, 1-47</td>
<td></td>
</tr>
<tr>
<td>performance of aircraft engines at, 13-48</td>
<td></td>
</tr>
<tr>
<td>rating of diesels at, 13-14</td>
<td></td>
</tr>
<tr>
<td>Altitude correction, compressor, 1-48</td>
<td></td>
</tr>
<tr>
<td>Alumina, effect on feedwater, 7-51</td>
<td></td>
</tr>
<tr>
<td>removal from feedwater, 7-51</td>
<td></td>
</tr>
<tr>
<td>solubility in feedwater, 7-52</td>
<td></td>
</tr>
<tr>
<td>Aluminum, emissivity, 3-21</td>
<td></td>
</tr>
<tr>
<td>nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-14</td>
<td></td>
</tr>
<tr>
<td>Ambient effect on thermometers, 18-06</td>
<td></td>
</tr>
<tr>
<td>American Bureau of Shipping, 15-72</td>
<td></td>
</tr>
<tr>
<td>American Locomotive Co, diesel engine, 13-19</td>
<td></td>
</tr>
<tr>
<td>American propjets (Table), 15-08</td>
<td></td>
</tr>
<tr>
<td>American wire gage, B. &amp; S., 16-08</td>
<td></td>
</tr>
<tr>
<td>Ammonia, 11-10 (see also NH₃) combustion, 2-04</td>
<td></td>
</tr>
<tr>
<td>critical-state properties, 3-60</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>Ammonia (continued)</td>
<td></td>
</tr>
<tr>
<td>gaseous, thermal conductivity, 3-16 viscosity, 1-15</td>
<td></td>
</tr>
<tr>
<td>liquid, thermal conductivity, 3-15</td>
<td></td>
</tr>
<tr>
<td>properties (Table), 11-11 superheated, chart, 11-12</td>
<td></td>
</tr>
<tr>
<td>properties (Table), 11-14</td>
<td></td>
</tr>
<tr>
<td>Ammonia-absorption refrigeration system, 11-31</td>
<td></td>
</tr>
<tr>
<td>Ammonia compressor performance (Table), 11-21</td>
<td></td>
</tr>
<tr>
<td>Ammonia condensers, dimensions (Table), 11-46 shell and tube-type (Table), 11-46</td>
<td></td>
</tr>
<tr>
<td>Ammonia solutions, specific volume (Table), 11-34</td>
<td></td>
</tr>
<tr>
<td>Ammonia-water solutions, 11-30</td>
<td></td>
</tr>
<tr>
<td>Amperes, formulas for (Table), 16-04 Analysis, airplane performance, 15-16</td>
<td></td>
</tr>
<tr>
<td>coal, 2-21 coke (Tables), 2-38, 2-39 dimensional, 5-04</td>
<td></td>
</tr>
<tr>
<td>feedwater, 7-50</td>
<td></td>
</tr>
<tr>
<td>Aneroid barometer, 19-06</td>
<td></td>
</tr>
<tr>
<td>Aneroid meter, 18-17</td>
<td></td>
</tr>
<tr>
<td>Angle of attack, 15-07</td>
<td></td>
</tr>
<tr>
<td>Angle valves, pressure loss, 6-39</td>
<td></td>
</tr>
<tr>
<td>Angles, functions of, 20-82</td>
<td></td>
</tr>
<tr>
<td>Angles of repose for coal, 2-32</td>
<td></td>
</tr>
<tr>
<td>Aniline cloud point, 13-33</td>
<td></td>
</tr>
<tr>
<td>Anion absorber in water treatment, 7-61</td>
<td></td>
</tr>
<tr>
<td>Annulus, geometry of the, 20-57</td>
<td></td>
</tr>
<tr>
<td>Anthracite coal, combustion, 2-04 (see also Coals) composition (Table), 2-26 size determination, 2-23 sizes, 2-20; 2-31 (Table) space occupied, 2-32 specifications (Table), 2-31</td>
<td></td>
</tr>
<tr>
<td>Anthracite cumb, 2-25</td>
<td></td>
</tr>
<tr>
<td>Anthracite slush, 2-25</td>
<td></td>
</tr>
<tr>
<td>Anti-freeze, diesel engine, 13-22</td>
<td></td>
</tr>
<tr>
<td>radiator, 14-83</td>
<td></td>
</tr>
<tr>
<td>solutions of, 14-63</td>
<td></td>
</tr>
<tr>
<td>Anti-knock requirements, automotive fuels, 14-87</td>
<td></td>
</tr>
<tr>
<td>Antimony, nuclear properties, 17-19</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-14</td>
<td></td>
</tr>
<tr>
<td>Apartment buildings, refrigeration requirements, 11-43</td>
<td></td>
</tr>
<tr>
<td>API, degrees, 2-47</td>
<td></td>
</tr>
<tr>
<td>API gravity (def), 13-32</td>
<td></td>
</tr>
<tr>
<td>Approach temperature, 7-46</td>
<td></td>
</tr>
<tr>
<td>cooling tower, 9-25</td>
<td></td>
</tr>
<tr>
<td>Aqua-ammonia solutions, properties, 11-31</td>
<td></td>
</tr>
<tr>
<td>Arches, furnace, construction of, 7-78</td>
<td></td>
</tr>
<tr>
<td>Archimedes spiral, geometry of, 20-68</td>
<td></td>
</tr>
<tr>
<td>Area, of circles, 20-27</td>
<td></td>
</tr>
<tr>
<td>measures of (Table), 20-45</td>
<td></td>
</tr>
<tr>
<td>metric equivalents (Table), 20-47</td>
<td></td>
</tr>
<tr>
<td>Area meters, 18-22</td>
<td></td>
</tr>
<tr>
<td>Area multiplier, in flow measurement, 1-13</td>
<td></td>
</tr>
<tr>
<td>Area multiplier data, in flow measurement, 1-14</td>
<td></td>
</tr>
<tr>
<td>Area ratio, gas flow, 3-56</td>
<td></td>
</tr>
<tr>
<td>Argon, critical-state properties, 3-60</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>Arithmetic mean temperature difference, 3-31</td>
<td></td>
</tr>
<tr>
<td>Armstrong Siddley Motors Ltd., turbojet, 15-67</td>
<td></td>
</tr>
<tr>
<td>Arresters, lightning, 16-40</td>
<td></td>
</tr>
<tr>
<td>Arsenic, nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>Articulated locomotives, 14-04</td>
<td></td>
</tr>
<tr>
<td>Mallet, 14-04</td>
<td></td>
</tr>
<tr>
<td>ASA code for pressure piping, 6-02, 6-06</td>
<td></td>
</tr>
<tr>
<td>Ash, coal, flow characteristics, 2-23</td>
<td></td>
</tr>
<tr>
<td>properties, 2-23</td>
<td></td>
</tr>
<tr>
<td>composition, 2-24</td>
<td></td>
</tr>
<tr>
<td>ferric percentage in, 2-24</td>
<td></td>
</tr>
<tr>
<td>fusibility, 2-22</td>
<td></td>
</tr>
<tr>
<td>fusion characteristics, 2-24</td>
<td></td>
</tr>
</tbody>
</table>
Ash (continued)
typical screen analysis, 7-90
viscosity, 2-23
Ash content, diesel fuel oil, 13-33
ASME-AIEE preferred standard turbines (Table), 8-12
ASME boiler construction codes, 7-17
ASME flow nozzles, installation, 1-21
ASME power test codes, list, 19-02
ASME standard flow nozzles, 1-19
Aspect ratio, 15-06, 15-11
correction, 15-10
Asphalt, heating value, 2-44
Athodyd, 15-19, 15-42
Atmosphere, the, 15-06 (see also Air)
furnace, 2-85
pressure, at altitude, 1-09
protective, in furnaces, 2-85
standard (Table), 1-09, 15-06
temperature at altitude, 1-09
at various altitudes (Table), 1-09
Atmospheric air, composition, 3-54
Atmospheric exhaust turbines, 8-52
Atmospheric relief valves, 9-15
sizes (Table), 9-16
Atomic energy, references, 17-20
Atomic Energy Act, 17-02
Atomic structure, 17-04
Atomization, oil, 2-50
air required (Table), 2-51
Atomizers, mechanical pressure, 2-51
oil, low-pressure air, 2-51
mechanical rotary, 12-52
Atomizing deaerator, 7-44
steam flow, 7-45
water flow, 7-44
Attached-block furnace walls, 7-79
Augmenter, jet or rotary, 15-63
Autogiros, 15-02
Automatic control, 18-23
references, 18-32
Automatic controllers, actions, 18-23
selection (Table), 18-32
Automatic extraction turbines, 8-12, 8-88
estimating method, 8-89
Automobile engines, 13-55 (see also Automotive vehicles)
Automotive engine cylinders, cast iron for (Table), 14-65
Automotive engineering, 14-61
Automotive engines, bearing data (Table), 14-73
(see also Engines)
centrifugal forces, 14-71
compression ratio, 14-76
cooling systems, 14-92
cylinder arrangement and number, 14-63
cylinders, 14-63
electrical system, 14-78
firing pressures, 14-77
fuel consumption, 14-77
fuel system, 14-78
heat balance (Table), 14-77
heat dissipation, 14-63
inertia forces, 14-71
manifolding, 14-78
mean effective pressure, 14-76
mechanical efficiency, 14-90
mixture ratio, 14-78
power correction factors (Table), 14-90
ring widths (Table), 14-86
starting characteristics, 14-74
tests, 14-88
valves, 14-86
Automotive fuels and combustion, 14-74
Automotive vehicles, brake tests, 14-87
brakes, 14-80
clutches, 14-82
economy tests, 14-87
final drive, 14-84
frames and springs, 14-79
maximum dimensions, 14-61
methods of drive, 14-79
performance factors, 14-61
power required, 14-02
propeller shaft, 14-83
resistance, 14-62
road tests, 14-86
steering gear, 14-84
steering mechanism, 14-85
torque converter, 14-83
transmissions, 14-82
wheel, 14-85
wheel caster, 14-85
wheel toe-in, 14-85
Automotrice, 14-40
Autotransformers, 16-72
Auxiliaries, diesel-electric locomotive, 14-38
ship, 15-81
Auxiliary equipment, gas-producer, 2-92
Auxiliary generators, locomotive, 14-39
Auxiliary turbine-generator sets, efficiency of, 8-60
Availability, diesel locomotive, 14-45
of energy, 3-53
Available energy, 4-04
Aviation fuels, data, 13-50
distillation range, 13-50
freezing point, 13-50
gum content, 13-50
heat of combustion, 13-50
knock rating, 13-50
maximum lead content, 13-50
specific gravity, 13-50
specification, 13-50
sulfur in, 13-50
vapor pressure, 13-50
Avogadro's law, 5-02
Axial-flow compressors, 1-51, 10-39
ASME test code, 19-02
blade angle, 1-104
blade attachment, 1-107
blade clearance, 1-107
blade lift coefficient, 1-101
blade stress, 1-106
blade vibration, 1-106
characteristics, 1-52
construction, 10-39
design, 1-110
efficiency, 1-97
flow coefficient, 1-105
free-vortex flow in, 1-105
mechanical design, 1-106
performance characteristics, 1-109
pressure coefficient, 1-105
pressure rise, 1-99
velocity diagrams (Table), 1-99, 1-102, 1-103
vortex design, 1-104
Axial-flow fans, 1-58, 1-93
characteristics, 1-95
references, 1-57
Axial-flow pumps, 5-80
Axle Journal, locomotive, 14-11
Back-work ratio, gas turbine, 10-11
Bacteria in ventilating air, 12-73
Bagasse, 2-43
Baker valve gear, 14-17
Balance, dynamic, 8-39
INDEX

Balance (continued)
static, 8-39
Balancing of locomotive driving wheels, 14-23
Bale capacity, ships, 15-69
Bail mills, pulverized-coal, 7-85
Bail-race mill, pulverized-coal, 7-85
Balloons, 15-02
Bars, lift valves, 8-48
Bare-plate furnace wall, 7-78
Bare-tube furnace walls, 7-78
Barium, nuclear properties, 17-19
Bark, heating value (Table), 2-43
Barometers, 19-06
- calibration and correction, 19-06
- conversion of pressure, 19-09
and mercury columns, correction to standard
gravity (Table), 19-08
- temperature corrections (Table), 19-07
and pressure gages, elevation corrections
(Table), 19-07
Barometric condensers, 9-03
dimensions, 9-04
tail pipe, 9-04
Base load (dof), 16-99
Beam of ships, 15-69
Bearing analysis, 14-73
Bearing data, automotive engine (Table), 14-73
Bearing pressures, compressor, 1-44
- locomotive, 14-11
Bearing temperature, 8-44
Bearings, aircraft engine, 13-42
- engine, 13-42
- forces on crankshaft, 14-72
- kilowatt loss, 8-44
- oil required, 8-44
- turbine, 8-43
Beattie-Bridgeman constants (Table), 3-57
Beattie-Bridgeman equation of state, 3-57
Beech Aircraft Corp., 15-04
Beehive coke, analysis, 2-38
Bell Aircraft Corp., 15-25
Bell gage, 18-17
Bellanca Aircraft Corp., 15-05
Bellows gage, 18-17
Bendix Helicopter, Inc., 15-25
Bends, flow resistance, 5-36
Bent-tube boilers, 7-09
Benzenef, combustion, 2-04
- data, 1-40
Bernoulli's equation, 1-22, 1-100
Bernoulli's theorem, 5-11
Beryllium, nuclear properties, 17-18
Bimetallic thermometers, 18-05
Bin system, pulverized-coal, 7-86
Binary-vapor cycles, 4-06
Binary-vapor refrigeration systems, 11-11
Binder, briquetting (Table), 2-42
Biplanes, 15-02
Birman wheel, 10-30, 10-40
Birmingham wire gage, 16-08
Bismuth, nuclear properties, 17-19
therm conductivity, 3-14
Bituminous coal, combustion, 2-04
- high-volatile, composition (Table), 2-27
- low-volatile, composition (Table), 2-26
- medium-volatile, composition (Table), 2-26
sizes, 2-32
- weight (Table), 2-32
Black body, radiation of, 3-20
Blade angle, axial-flow compressor, 1-104
Blade attachment, axial-flow compressor, 1-107
Blade clearance, axial-flow compressor, 1-107
Blade gaging, 8-24
Blade material, 8-26
Blade stress, axial-flow compressor, 1-106
Blades, stress in steel, 8-23
turbine, 8-19
Blading, reaction, 8-22
Blading materials, gas turbine, 10-34
Blanket and batt insulations, thermal conductivity,
12-06
Blaze furnaces, compression of air for, 10-09
Blaze heaters, 12, 47
allowable velocities (Table), 12-49
rating, 12-47
selection, 12-47
temperature rise, 12-47
Blaze heating systems, 12-44
Blow-out diaphragms, 9-16
Blowdown of boilers, 7-63
Blowers, 1-57
ASME test code, 19-02
- references, 1-57
- traction motor, for locomotive, 14-39
Blue gas, 2-77
data (Table), 2-78
Boeing Aircraft Co., 15-04
Bobhead coal, 2-90
Boilers, 7-02 (see also Steam-generating units)
ASME test code, 19-03
- bent-tube, 7-09
- blowdown, 7-63
- capacity of various types, 7-05
- carbon monoxide loss, 7-13
carryover, 7-19
cow-fired, combustion rates (Table), 12-22
codes of various states, 7-18
combustion in-refuse loss, 7-13
combustion rate (Table), 7-04
construction, ASME rules for, 7-17
- ASME codes for, 7-17
- Coast Guard rules for, 7-17
- code for, 7-16
- Navy specifications for, 7-17
- Lloyd's rules for, 7-17
- rules for, 7-18
corrosion, 7-62
cost, 7-06
desgn, 7-12
draft loss, 7-16
dry-gas heat loss, 7-13
efficiency (dof), 7-12
enforcement of rules for, 7-17
fire-tube, 7-07
- generating capacity, 7-05
- fly ash in, 7-94
- forced-circulation, 7-08, 7-09
fuel-burning equipment, 7-03
fuel-burning rates (Table), 7-04
fuel characteristics, 7-03
heat balance, 7-12, 7-13
heat losses, 7-13
heat transfer, 7-14
heat transfer rates, 7-10
heating, pickup allowance, 12-20
- selection, 12-21
horizontal-return tubular, wall construction,
7-76
- locomotive, 14-18
- capacity, 14-08
effect of fire-tube length, 14-08
- water heating, 14-39
maximum design pressure (Table), 7-05
maximum steam temperature (Table), 7-06
moisture loss, 7-13
once-through, 7-09
pressure firing of, 10-08
priming, 7-20, 7-63
INDEX

Boilers (continued)
- radiation loss, 7-14
- recirculation type, 7-09
- references, 7-30
- SBT ratings, for commercial (Table), 12-19
  for residential (Table), 12-18
- sectional-header, 7-08
- selection, 7-03, 12-16
- semivertical, superheaters, 7-26
- ship, 15-80
- space requirements, 7-06
- steam, 7-03
- steam conditions, 7-05
- steam purification, 7-23
- stoker-fired, fly ash from, 7-92
- superheaters for straight-tube, 7-25
- superheating process in, 7-24
- test code, 19-12
- three-drum low-head, 7-07
- three- or four-drum vertical, 7-07
- two-drum, 7-07
- types, 7-07
- waste-heat, 7-08, 7-30, 7-39
- water tube, 7-08
- wall construction, 7-76
- Boiler drums, steam purification in, 7-23
- Boiler efficiency (def), 7-12
- determination, 7-12
- Boiler equipment, selection, 7-10
- Boiler-feed pumps, 7-42
  - materials, 7-42
  - minimum flow, 7-42
  - reciprocating, 7-43
  - speed, 7-43
  - suction head requirements, 7-42
- Boiler feedwater, chemistry of, 7-50
- Boiler firing, references, 7-82
- Boiler foaming, 7-63
- Boiler foamover, 7-20
- Boiler furnaces, 7-63
- details, 7-74
- references, 7-82
- Boiler horsepower, 7-12
- Boiler load, effect on fly ash, 7-94
- Boiler losses, 7-13
- Boiler performance, 7-12
- Boiler rating table, IBR, 12-18
- Boiler ratings, 12-16
- Boiler scale, 7-54
- Boiler water, alkalinity, 7-52
  - chlorides in, 7-52
  - pH value, 7-52
  - sodium phosphate in, 7-52
  - solids in, 7-52
- Bolling, 3-07
- Bolling liquids, heat transfer for, 3-26
- Bolling point, butane, 2-60
  - chemical elements (Table), 3-06
  - increase by salts (Table), 3-08
  - inorganic compounds (Table), 3-07
  - organic compounds (Table), 3-08
  - propane, 2-60
  - sodium chloride solutions (Table), 3-74
- Bolling, 6-05
- Bolts, turbine, 8-51
- Bonneville Plant, 5-30
- Bore and stroke, aircraft engine, 13-52
- Bore of typical internal-combustion engines
  (Tables), 15-17, 13-18, 15-19
- Boundary layer control, 15-12
- Bourdon gages, 15-17, 19-11
- Bow shock, 15-32
- Brake air compressors, train, 14-38
- Brake horsepower, 13-05

Brake horsepower (continued)
- aircraft engine, 13-44
- correction to standard conditions, 13-44
- diesel, 13-18
- equation, 13-44
- of typical internal-combustion engines (Tables),
  13-17, 13-18, 13-19
- Brake mean effective pressure, 13-05; 13-44 (def)
- Brake pedal pressure, 14-82
- Brake self-actuation, 14-81
- Brake tests, automotive vehicle, 14-87
- Brakes, automotive vehicle, 14-80
  - locomotive, 14-58
- Braking, locomotive electric dynamic, 14-30
  by reversible-pitch propeller (Table), 15-21
- Braking effort, diesel locomotive, 14-30
- Brass, emissivity, 3-21
  - red, thermal conductivity, 3-14
  - yellow, thermal conductivity, 3-14
- Brass pipe (Table), 6-32
- Brayton cycle, 10-03, 15-43
- Breguet's range formula for airplanes, 15-18
- Brick, conductivity, 11-37, 12-04
- Brine bunker system, in refrigeration, 11-42
- Brine circulating system, in refrigeration, 11-50
- Briquets, 2-42
- analysis (Table), 2-42
  - heating value (Table), 2-42
  - Lurgi lignite-char, 2-38
  - production, 2-43
- Bristol Aeroplane Co., Ltd., propjet, 15-68
- British Imperial gallon, 20-44
- British standard wire gage, 16-08
- British thermal unit (Btu), 3-02, 3-51
- Bromine, nuclear properties, 17-18
- Bromocresol green, 7-53
- Bromocresol purple, 7-53
- Bromophenol blue, 7-53
- Bromothymol blue, 7-53
- Brown Boveri gas turbines (Table), 10-20
- Btu, 3-03, 3-51
  - Btu value, commercial gases (Table), 2-64
  - Buchi system of supercharging, 13-09
  - Buchi turbochargers, 10-04
  - manifold diagram, 10-07
  - Bucket clearance, 8-26
  - Bucket fabrication, 8-24
  - Bucket length, 8-26
  - Bucket material, 8-26
  - Bucket passages, compression in, 8-19
  - Bucket shrouds, 8-24
  - Bucket taper, 8-24
  - Bucket velocity coefficient, 8-19
  - Bucket vibration, 8-21, 8-36
  - Buckets, 8-19
  - centrifugal force on, 8-25
  - correction factor for end effects, 8-19
  - erosion, 8-25
  - hydraulic turbine, 5-42
  - loss, 8-19
  - spacing, 8-24
  - Buckingham's pi theorem, 5-05
  - Buda diesel engine, 13-17
  - Buda–Lanova diesel engine, 13-18
- Building board, thermal conductivity, 12-04
- Building materials, conductivities (Table), 12-04
  - thermal properties (Table), 12-04
- Buildings, estimation of hot water for, 12-17
  - heat loss, 15-02
- Burners, combination oil and gas, 2-52
  - gas, 7-71
  - oil, 7-72
    - mechanical-atomising, 7-74
    - steam-atomising, 7-72
INDEX

Burners (continued)
- pulverised-coal, 2-36, 7-88
- fly ash from, 7-92
- range of, 7-89
- steam-atomising, 2-51

Butane, combustion, 2-04
- critical-state properties, 3-60
  data, 1-40
  properties (Table), 2-60

Butt welds in pipe, 6-13

Butter, heating value, 2-44

Butterfly valves, 18-27

Butylene, combustion, 2-04
  data, 1-40

By-product coke, analysis, 2-38

C.F.R. engine, 14-75

Cables, aerial electric, 16-73
- drag of, 15-15
- electric, 16-73
  for industrial applications (Table), 16-74
  operating temperature (Table), 16-31

Cadmium, nuclear properties, 17-18
- thermal conductivity, 3-14

Caesium, nuclear properties, 17-19

Calcium, nuclear properties, 17-18

Calcium chloride brine, properties (Table), 11-51

Calcium compounds, boiler scaling properties, 7-54
- effect on feedwater, 7-51
  removal from feedwater, 7-51
  solubility in feedwater, 7-52

Calculations, gas, 2-75

Calculus, 20-72
- integral, 20-77

Call Aircraft Co., 15-05

Calorie, mean, 3-02

Ostwald, 3-02

Calorific value, fuels (Table), 2-04 (see also
  Heating value)
- commercial gases (Table), 2-64

Calorimeter, electric, 7-22
- separating, 7-22
- throttling, 7-21
- universal, 7-22

Camber, automotive vehicle wheel, 14-85

Campini, 15-42

Canadian turbojets (Table), 15-66

Canals, permissible velocities in (Table), 5-17
- water flow in, 5-15

Cannel coal, 2-20
- composition (Table), 2-30

Capability, turbine, 8-64

Capacitance, of controlled process, 18-28
- of a line, 16-03
- liquid, 18-28
- pressure, 18-28
- process, units of, 18-28
- thermal, 18-28

Capacitor rating, for generators, 16-48
- recommended for induction motors (Table), 16-47

Capacitors, location of, 16-48

Capacity, boiler, 7-05
- of compressors, actual, 1-43
- ice-making, 11-49
- metric equivalents (Table), 20-48
- refrigeration suction line (Table), 11-24
- steam engine, 8-102
- steam-jet air ejector, 9-18
- thermal, 3-03

Capacity factor (def), 16-99

Capacity regulation of centrifugal pumps, 5-70

Capstan, 15-82

Carbon, combustion, 2-04
- Conradson, 13-33
- graphic, thermal conductivity, 3-14
- nuclear properties, 17-18

Carbon dioxide, 11-10
- Beattie-Bridgeman constants, 3-57
- critical-state properties, 3-60
  data, 1-40
- density (Table), 5-03
- effect on feedwater, 7-51
- emissivity, 3-24
- gas constants, 3-54
- kinematic viscosity (Table), 5-03
- mass density (Table), 5-03
- maximum, for C-H rates, 2-49
- modulus of elasticity (Table), 5-03
- molar heat capacity (Table), 2-10
  properties (Table), 11-15
- in refrigeration, 11-15 (Table); 11-17
- removal from feedwater, 7-51
- solid, 11-02
- solubility in feedwater, 7-52
- specific heat at zero pressure, 3-58
- thermal conductivity, 3-15, 3-16
- ultimate percentage of, for gases (Table), 2-64
- viscosity, 1-15, 5-03 (Table)

Carbon disulphide, combustion, 2-04
  data, 1-40

Carbon-hydrogen ratio, 2-49

CO₂ and excess air (Table), 2-49

Carbon monoxide, Beattie-Bridgeman constants, 3-57
- combustion, 2-04
- critical-state properties, 3-60
  data, 1-40
- gas constants, 3-54
- specific heats at zero pressure, 3-58
- viscosity, 1-15

Carbon residue, from diesel fuel oils (def), 13-33
- from fuel oils, 2-46

Carbon ring glands, turbine, 8-42

Carbon tetrachloride, critical-state properties, 3-60
  data, 1-40

Carbonaceous cation exchanger, 7-60

Carbonic acid, effect on feedwater, 7-51
- removal from feedwater, 7-51

Carburetion, in aircraft engines, 13-49

Carburetors, 14-78
- float chamber, 13-49
- pressure, 13-49

Carburetted fuels, heat balance (Table), 2-82

Carburetted water gas, 2-64, 2-81 (Table); 2-80
  data, 1-40

Cargo winches, 15-82

Carnot cycle, 4-05

Carrenne, 11-10

Carrene, 11-14
- properties (Table), 11-15

Carrover, boiler, 7-19
- in boilers, types, 7-20
- in turbines, 8-16

Cascade operation of circuit breakers, 16-55

Cascading of feedwater heaters, 7-49

Cast iron for automotive engine cylinders (Table), 14-65

Cast-iron pipe, 6-02

Cast-iron radiators, dimensions and ratings (Table), 12-14

Caster, automotive vehicle wheel, 14-85

Catenary, geometry of, 20-58

Caterpillar diesel engine, 13-18

Cation exchangers, hydrogen-cycle, 7-60
- sodium-cycle, 7-60
INDEX

Caustic embrittlement, 7-62
Cavitation, in centrifugal pumps, 5-68
in hydraulic turbines, 5-37
materials to resist, 5-38
Cavitation coefficient, hydraulic turbine, 5-37
Cavitation constant, 5-87
Ceding, airplane, 15-18
Cement, firebrick and refractory, 2-54
Center of pressure of airfoils, 15-09
Center-of-pressure coefficient, 15-09
Center-of-pressure travel of airfoils, 15-09
Centigrade absolute scale, temperature, 18-02
Centigrade to Fahrenheit, conversion (Table), 18-02, 18-03
Centigrade to Kelvin, conversion of, 18-02
Centipoise (def), 6-41
Centistoke (def), 6-42
Centrifugal compressors, 1-51
ASME test code, 19-02
gas turbine, 10-40
multistage, performance, 1-51
performance curves, 1-52
refrigeration, 11-22
velocity diagram, 1-53
Centrifugal concentrators for fly ash, 7-95
Centrifugal fans, 1-58, 1-72
characteristics, 1-77
Centrifugal forces in automotive engines, 14-71
Centrifugal pumps, 5-48 (see also Pumps, centrifugal)
critical speed, 5-70
Centrifugal separators for fly ash, 7-95
Centrifugal stiffening effect of turbine buckets, 8-37
Certum, nuclear properties, 17-19
Cessna Aircraft Co., 15-05
Cetane number, 15-33
Chain grate stokers, 7-64, 7-65
boiler capacity range, 7-05
combustion rate, 7-04, 7-66, 7-68
combustion volume, 7-66
draft losses, 7-67
forced-draft, 7-67
host-release rate, 7-75
manufacturers, 7-71
minimum ash content, 7-65
natural draft, 7-66
operation, 7-66
Characteristics, airship, 15-27
axial-flow compressor, 1-52
of logarithms, 20-02
method of, 15-35
rigid airships (Table), 15-27
U. S. ships (Table), 15-69
Charcoal, 2-41
by-products, 2-41
production, 2-41
specifications, 2-41
Charts, psychrometric, 1-07, 1-08, 11-39, 12-76
Chassis, automobile, 14-79
Chemical composition of condenser tube materials (Table), 9-13
Chemical elements, boiling points (Table), 3-06
melting points (Table), 3-06
specific heats (Table), 3-04
Chemical properties, pipe materials, 6-02
of steels for tubing (Table), 6-20
Chemistry of boiler feedwater, 7-50
Chemistry of combustion, references, 2-12
Chemistry of feedwater, references, 7-63
Chézy equation, 5-14
Chicago Pneumatic diesel engine, 13-19
Chimneys, dimensions (Table), 12-23
Chimneys (continued)
heating boiler, 12-23
Chlorine, critical-state properties, 3-60
data, 1-40
nuclear properties, 17-18
thermal conductivity, 3-16
viscosity, 1-15
Chords of arcs (Table), 20-50
Chromel-alumel thermocouples (Table), 18-07, 18-09
Chromel-constantan thermocouples, 18-07
Chromium, nuclear properties, 17-18
Cippoletti weir, 5-20
Circles, area, and circumference (Tables), 20-27, 20-54
geometry of, 20-56
Circuit arrangements, power distribution, 16-23
Circuit breakers, cascade operation, 16-55
drawout air (Table), 16-55
480- and 600-volt (Table), 16-58
for motor circuits (Table), 16-89
power, 16-29
ratings (Table), 16-53
short-circuit current (Table), 16-29
208- and 240-volt (Table), 16-56
Circuit constants, 16-03
Circuits, single-phase, 16-04
three-phase, 16-05
two-phase four-wire, 16-05
Circular arcs (Table), 20-50
geometry of, 20-56
Circular measure (Table), 20-46
Circular sector, geometry of, 20-57
Circular segment, geometry of, 20-57
Circulating water, velocity, condenser, 9-09
Circumference and area of circles, 20-27
Classification, aircraft engine, 13-41
coil, by grade, 2-19
in pulverizing mills, 7-83
by rank, 2-18
by size, 7-83
by type, 2-20
diesel engine, 13-02
Classifier, pulverized-coal, centrifugal type, 7-85
Clausius cycle, 4-04
Cleaning, air preheaters, 7-38
economizers, 7-31
Clearance, refrigeration compressor, 11-08
Clearance space, steam engine (Table), 8-104
Climb rate of airplanes, 15-18
Clinker grinder, 7-69
Closed conduits, flow in, 5-12
Closed cycle gas turbine (def), 10-11
Closed feedwater heaters, 7-45
Cloud point, aniline, 13-33
Clutches, automotive vehicle, 14-82
electromagnetic, 14-39
Coagulants, in foodwater treatment, 7-55
Coal analyses, methods of reporting, 2-22
Coal gas, 2-44 (Table), 2-81
Coal grinding, principles, 7-82
Coal pulverizers, ASME test code, 19-02
energy required, 7-83
Coal size, classification, 7-83
Coal systems, pulverized, 7-86
Coal tar, 2-60
Coals, agglomerating properties (Table), 2-31
(see also Pulverized coal)
alternate firing, 7-64
analysis, 2-21
angle of repose, 2-32
chemical elements in, references, 7-97
classification, 2-17
in pulverizing mills, 7-83
INDEX

Coals (continued)
  coking-firing of, 7-64
  combustion, 2-34
  combustion rate, 7-64
  common banded, 2-20
  compositions, 2-24
  contracts for purchase, 2-24
  cost of burning, 7-03
  crushing, 7-82
  data, 2-24
  drying of, in pulverizing mills, 7-83
  effect of type on fly ash, 7-03
  expansion pressure during coking, 2-22
  fineness test, 2-23
  grates and stokers, 2-34
  grindability, 2-22; 7-84 (Table)
  methods of burning, 7-64
    of sampling, 2-21
    of storing, 2-33
  mixtures of hard and soft, 2-32
  plastic properties, 2-22
  preparation for pulverizing, 7-82
  properties, by regions (Table), 2-26
  pulverized, 7-82
  references, 2-44
  rough sizing, 7-82
  sampling, 2-31
  special tests, 2-22
  specifications, 2-24
  splint, 2-20
  for spreader stokers, 7-71
  surface area (Table), 2-33
  symbols for grading, 2-19
  types of stokers (Table), 7-64
  weathering of, 2-33
  Coast Guard boiler construction rules, 7-17
  Coatesville evaporation tests, locomotive, 14-06
  Cobalt, nuclear properties, 17-18
  Codes, boiler construction, 7-16
    enforcement of boiler, 7-17
    factors of safety in boiler, 7-17
    piping, 6-02
    pressure piping, 6-06
    for unifired pressure vessels, 7-17
  Coefficient, absolute viscosity, 6-41
    absorption, gamma-ray, 17-06
    Admiralty, 15-71
    center-of-pressure, 15-90
    of contraction, fluid flow, 5-09
    cross-flow, 3-31
    of discharge, 1-13
    orifices and tubes (Table), 3-10
    for eddy loss (Table), 5-13
    film, 3-17
    data, 3-19
    equivalent in radiation, 3-23
    flow, 1-13
      axial-flow compressor, 1-105
      of friction, fluid flow, 5-09
    gas film, 3-19
    heat transfer, surfaces in water (Table), 3-18
    lift, in compressor blades, 1-101
    and drag, 15-07
    liquid film, 3-19
    manometric, of pumps, 5-52
    noxie, 1-18, 1-20
    orifices with sharp edges (Table), 5-11
    Parsons, in turbines, 8-58
    of performance, refrigeration, 3-52, 11-06
    pressure, axial-flow compressors, 1-105
    propeller, aircraft, 15-20
    pump capacity, 5-53
    pump head, 5-53
    temperature, in nuclear reactivity, 17-13
  Coefficient (continued)
    temperature reactivity, 16-07
    velocity, 8-19
  Coke, 2-37
    analyses (Tables), 2-38, 2-39
    methods of sampling, 2-21
    production and disposal, 2-37
    references, 2-44
    thermal conductivity, 3-14
    types, 2-38
  Coke breeze, 2-37
  Coke-oven gas, 2-64 (Table); 2-81
  Cold-air machines, refrigeration, 11-03
  Cold lime-water process, feedwater, 7-55
  Cold reserve in power plants (def), 16-100
  Cold storage, 11-41
    humidity in, 11-42
  materials (Table), 11-37
  Cold surfaces, mediation of, 3-41
    prevention of condensation, 3-41
  Cole ratios for steam locomotives, 14-06
  Collector chamber, centrifugal compressor, 10-40
  Collectors, fly-ash, 7-04
  Color dynamics, in instrumentation, 18-33
  Colorimetric indicator solutions (Table), 7-53
  Columbian, nuclear properties, 17-18
  Combustion, 2-01
    air required, 2-08
    coal, 2-34
    definition, 2-02
    gas, references, 2-86, 2-87
    heat of, gas (Table), 2-82
    mechanism of, 2-02
    products of, 2-04 (Table); 2-93
    gas (Table), 2-04
    pulverized coal, 7-87
    references, 2-12
    spontaneous, 2-33
    volume relationships, 2-03
    weight relationships, 2-02
    wood, 2-40
  Combustion calculations, 2-07
  Combustion chamber, diesel, 13-04
    gas turbine, 15-55
    in hand-fired boilers, 7-64
    liquid fuel, design, 2-53
    locomotive boiler (Table), 14-07
    metal, for oil burners, 2-54
    turbojet, 15-52
  Combustion gas turbines, 10-02 (see also Gas
    turbines)
  Combustion gasses, properties, 2-93
  Combustion products, properties (Table), 2-94
  Combustion rate, in boilers (Table), 7-04
    chain-grate stokers, 7-66, 7-68
    coal, in boilers, 7-64
    coal-fired heating boilers, 12-22
    grates, 7-64
    multiple-retort stoker, 7-04
    overfeed stokers, 7-65
    pulverized coal, 7-04
    single-retort stoker, 7-04
    spreader stokers, 7-71
    stokers, 7-04
    underfeed stokers, 7-69
  Combustion reactions (Table), 2-04
  Combustion space requirements of furnaces, 7-66
  Combustion theories, fuel oil, 2-49
  Combustion volume, effective, for fuel oil, 2-53
  Combustors, gas turbine, 10-40
    range of operation, 10-42
    types, 10-43
  Comfort cooling, 12-77
  Common logarithms of numbers (Table), 20-05
INDEX

Component efficiencies, effect on gas turbines, 10-14
Jet propulsion, 15-56
Composition, butane, 2-60 (see also name of substance)
cost, 2-24
fly ash, 7-91
propane, 2-60
wood, 2-40
Compound cycles, 10-02
performance (Table), 10-06
Compound engines, fuel rate of (Table), 10-06
ps diagrams, 10-08
weight, 10-06
Compound gas turbine cycles, 10-04, 10-07
Compound steam engines, 8-106
Compounding, aircraft engine, 13-49, 13-50
engine, 10-04
Compounds, boiler, effect on feedwater, 7-51
Compressed air, 1-34
friction in hose lines, 1-55
hosing sizes, 1-55
pressure drop (Table), 1-55
references, 1-57
Compressible flow, equations, 6-45
with friction, 6-45
fundamental equation, 1-11
special equations, 1-12
Compressible-flow airfoils, 15-10
Compressible fluid, critical flow of, 1-12
flow of, 15-28
Compression, of gases, horsepower required, 1-46
isentropic work, 10-02
isothermal, 1-38
power required for air, 15-48
process gas, 10-09
wet, in refrigeration, 11-09
Compression pressure, gas engine compressor, 13-56
Compression process, diesel engine, 13-07
Compression ratio, 13-45
aircraft engine, 13-45, 13-52
automotive engine, 14-76
effect on engine fuel consumption, 13-47
effect on engine power, 13-47
effect on Otto and diesel cycles, 13-06
Compression shocks, 3-70
Compressor test, flow nozzle arrangement for, 1-21
Compressors, actual capacity, 1-43
air, design data, 1-44
altitude correction, 1-48
ammonia, performance (Table), 11-21
ASME test code, 19-02
axial-flow, 1-37, 1-96, 10-38
blade angle, 1-104
blade attachment, 1-107
blade clearance, 1-107
blade lift coefficient, 1-101
blade stress, 1-106
characteristics, 1-52
construction, 10-39
efficiency, 1-97
flow coefficient, 1-105
free-vortex flow in, 1-105
performance, 1-52, 1-109
pressure coefficient, 1-105
pressure rise, 1-60
velocity diagrams, 1-99, 1-102, 1-103
vortex design, 1-104
bearing pressures, 1-44
centrifugal (cross section), 1-37
gas turbine, 10-40
performance curves, 1-52
Compressors, centrifugal (continued)
vector diagrams, 1-53
characteristics, of axial-flow, 10-37
of centrifugal, 10-37
of Lysholm, 10-37
cylinder lubrication, 1-53
dimensions and performance, 1-53
discharge temperature, 15-48
drives for, 1-47
effect of altitude, 1-47
gas-engine, 13-55
gas turbine, blade tip speed, 10-38
comparative cost, 10-38
comparative efficiency, 10-38
comparative rpm, 10-38
comparative size, 10-38
comparative stability, 10-38
comparison of designs (Table), 10-38
effect of inlet temperature on performance, 10-16
ergy balance, 15-44
number of stages, 10-38
size, 10-38
stability, 10-38
weight, 10-38
governing of, 1-47
horsepower chart, 13-57
hydraulic, 1-49
isentropic horsepower, 1-42
jet (cross section), 1-37, 1-49
Lysholm, 10-40
construction, 10-41
performance, 10-41
performance, 1-46
performance theory, 1-38
portable (cross section), 1-38
positive displacement, typical data, 1-44
reciprocating (cross section), 1-35
indicator cards, 1-43
performance curves, 1-45, 1-47
piston displacement, 1-43
refrigeration, 11-20
refrigeration, data (Table), 11-22
slippage efficiency, 1-44
volumetric efficiency, 1-43
references, 1-57
refrigeration, 11-20
rotary, 1-36, 1-49
performance, 1-49
stability (def), 10-39
stalling, 1-109
supersonic, 10-39
surging, 1-109
tip speeds, 1-53
train brake air, 14-38
turbo-, 1-51
region of instability in, 1-52
turbojet, 15-51
types, 1-34
types of stage, 1-103
valves, 1-44
vibration of blades, 1-106
work chart, 1-39
work with intercooling, chart, 1-43
Comprax, 10-41
gas turbine (def), 10-11
Concrete, thermal conductivity, 3-14, 11-37, 12-04
Concrete blocks, thermal conductivity, 12-05
Concrete linings, water flow through, 5-15
Condensate pump efficiency, 8-37
Condensate surge space, 7-45
Condensation on cold surfaces, prevention, 3-41
Condenser steam rate, 8-81
Condenser tube sheets, 9-12
INDEX

Condenser tubes, 9-12
chemical composition of materials for (Table), 9-13
natural frequency, 9-14
spacing, 9-12
Condensers, 9-02
air-removal equipment, 9-16
ASME test code, 19-03
barometric, 9-03
dimensions, 9-04
cleanliness, 9-15
direct-contact, 9-02
double-pipe ammonia, refrigeration, 11-46
effect of leakage on vacuum, 9-15
ejector, 9-07
evaporative, in refrigeration, 11-47
flooded, in refrigeration, 11-45
jet, 9-02
dimensions, 9-03
maximum suction lift, 9-02
permissible overloads, 9-02
stability chart, 9-03
water required, 9-07
shell-and-tube, in refrigeration, 11-45
shells for, 9-12
ship, 15-80
surface, 9-07
air leakage, 9-15
circulating water velocity, 9-09
construction details, 9-12
construction materials, 9-12
design, 9-11
design calculation, 9-10
dimensions of two-pipe, 9-14
heat transfer coefficients, 9-08
selection of tube diameter, 9-09
tube data (Table), 9-09
tube length, 9-09
tube pressure drop, 9-09
water-box losses, 9-09
tube installation, 9-12
water boxes for, 9-12
Condensing turbines, efficiency (Table), 8-61
no-load steam consumption (Table), 8-64
Condensing vapors, heat transfer, 3-27
Condition curve, turbine, 8-63, 8-68
Conductance, radiation, 3-39
surface, 3-38
references, 3-49
thermal, 12-03
with wind, 3-39
thermal, building materials, 12-09
definition, 12-03
of vertical air spaces (Table), 3-40
Conduction, 3-12
and convection, combined, 3-28
heat, through concentric cylinders, 3-13
through plane materials, 3-13
radial, 3-13
unsteady, approximate solution, 3-15
thermal, principles of, 3-13
steady state, 3-13
unsteady, 3-15
Conductivity (Table), 11-37
building materials (Table), 12-04
for calculating heat-loss coefficients (Table), 12-08
of insulating materials (Table), 12-04
thermal (def), 12-03
refractories (Table), 3-37
units, 3-13
various materials (Table), 3-37
variable, 3-36
Conductor size, estimation of (Table), 16-35
Conductor temperature, effect of current magnitude, 16-34
effect of size, 16-34
Conduit bends, eddy losses at, 5-13
Conduit entrances, losses at, 5-12
Conduit losses, skin friction, 5-14
Conduit valves, eddy losses at, 5-13
Conduits, eddy losses in, 5-12
flow of water in, 5-11
loss of head in, 5-12
miscellaneous data, 5-17
Cone, general geometry of, 20-40
right circular, geometry of, 20-40
Conformal transformation, 5-09
Connected load (def), 16-09
Connecting rods, aircraft engine, 13-42
engine, 13-12
Conowingo Plant, 5-30
Consolidated Vultee Aircraft Corp., 15-04
Consolidated Vultee-Stinson Div., 15-05
Constant circulation blade design, 10-31
Constant-speed drives, hydraulic couplings for, 5-84
Constantan, thermal conductivity, 3-14
Constants, Beattie-Bridgeman (Table), 3-57
circuit, 16-03
combustion, of fuel gases (Table), 2-02
containing e and v (Table), 20-29
for determining capacity of unit heaters (Table), 12-56
equilibrium, producer gas reactions (Table), 2-89
gas, 5-02
Planck's, 17-02
Construction, of boilers, rules for, 7-18
of furnace arches, 7-78
of open feedwater heaters, 7-45
Continental engines, 13-52
Continental Lanova diesel engine, 13-17, 13-18
Continental System, electric locomotive classification, 14-47, 14-48
Continuity equation, 1-22, 1-100, 3-52, 8-17
Continuous-tube economizers, 7-32
Contraction, coefficient of, fluid flow, 5-09
Contractions, sudden, 5-13
Control, application of, to processes, 18-30
automate, 18-23
references, 18-32
complex gas turbine cycles, 10-46
fans, 1-90
flow, 18-31
liquid-level, 18-31
oil burner, 2-52
pressure, 18-30
propjet, 15-43
proportional-speed floating, 18-30
simple-cycle gas turbine, 10-46
single-speed floating, 18-30
stability, 18-30
steam temperature in boilers, 7-27
temperature, 18-31
turbojet, 15-62
two-position, 18-30
Control center, in process control, 18-33
Control elements, final, in processes, 18-27
Control systems, 18-30
Control valves, turbine, 8-49
Controller actions, application (Table), 18-31
Controllers, actions of, 18-23
automate, 18-23
selection, 18-32
contact type, 18-26
electric, 18-25
hydraulic, 18-27
INDEX

Critical temperature, 3-61
Critical viscosity, temperature, 2-24
Cross-compound compressor, 1-35
Cross-flow correction factor, heat exchangers, 3-51
Cross sections, nuclear, 17-07
Crossfeed stoker, 2-35
Crossheads, locomotive, 14-16
Cruising power, aircraft engine, 13-52
Cruising speed, aircraft engine, 13-52
airplane, 15-18
Crushing of coal, 7-82
Cube roots of numbers, 20-27
Cubes of numbers, 20-27
Cubic foot, equivalents (Table), 20-44
Cummins diesel engine, 13-09, 13-18
Curies, 17-19
Curran-Knowles coke ovens, 2-38
Current, balanced, 16-36
differential, 16-36
magnetizing, 16-41
power-producing, 16-41
short-circuit, 16-27
Current balance trip, 16-32
Current capacity, copper bars (Table), 16-06
Current meters, flowing water, 3-20
Curtsis stage, turbines, 8-02
Curtsis-Wright Corp., 15-04
Curve resistance, locomotive, 14-04
Cut-offs, locomotive engine, 14-08
Cycle, air-standard, 13-06
binary-vapor, 4-06
Carnot, 4-05
compound, gas turbine, 10-07
power plant, references, 4-29
reheating, 11-03
steam and binary, plant performance (Table), 8-93
steam-power, 4-02
steam regenerative, 4-05
steam regenerative-reheat, 4-06
steam reheated, 4-05
steam-turbine, 8-14
Cycle efficiency, mercury, 8-95
modified gas turbine, 15-44
Cyclogyro, 15-02
Cycloid, geometry of, 20-58
Cylinder jackets, cooling water requirements, 1-55
Cylinder lubrication, rate of oil feed, 1-54
steam engine, 8-112
Cylinder oil, characteristics, 1-04
Cylinders, aircraft engine, construction, 13-43
general, geometry of, 20-60
number of, in typical internal combustion engines (Tables), 13-17, 13-18, 13-19
right circular, geometry of, 20-60
Damper control, fans, 1-91
superheater, 7-35
Dams, flow over, 5-18
Darcy formula, 5-07
Davis formulas for tractive resistance, 14-48
D-c to a-c power conversion, 16-83 (see also direct current entries)
Dead time, control systems, 18-29
controlled processes, 18-26
Deadweight gages, 19-11
Deadweight of ships, 15-69
Deaerating feedwater heater, tray-type, 7-43
Deaerator, atomizing, 7-44
Decimal equivalents of numbers, 20-27
Degree-days (Table), 12-22
Degrees, API (def), 13-32
Degrees (continued)
decimals of, minutes and seconds (Table), 20-53
values of radians in (Table), 20-53
DeHaviland Aircraft Co. Ltd., turbojet, 15-67
Dehumidifying air washer, 13-25
Delta-delta transformer connections, 16-70
Delta-star transformer connections, 16-70
Demand (def), 16-09
Demand factor, 16-12; 16-100 (def)
Demineralization treatment of water, 7-61
Density, air, 1-09 (see also name of substance) of the atmosphere at altitude, 1-09
common fluids (Table), 5-03
flue gas in fan practice, 1-63
gas, 2-75
metric equivalents (Table), 20-48
of mixtures, 2-03
Deposits, in air preheaters, 7-38
removal of turbine, 8-55
turbine, 8-26
Depreciable value, 16-91
Depreciation, 16-91
average rates (Table), 16-93
diminishing-value, 16-92
reducing-balance, 16-02
sinking-fund, 16-92
straight-line, 16-92
Depreciation accounting, 16-92
Depreciation expense, 16-91
Depth, ships, 15-09
Design calculations, turbojet, 15-53
Design considerations, marine, 15-69
Design criteria, gas turbine, 10-35
Design data, air compressors, 1-44
air-removal systems, 9-19
Desuperheaters, 7-28
Desuperheating in feedwater heaters, 7-43
Detached shock, 15-32
Detergent oils, 14-69
Detonation, aircraft engine, 13-47
automotive engine, 14-92
Dew-point temperature, 12-74
Diagram factors, steam engine (Table), 8-103
Diameter speed, locomotive, 14-11
Diaphragm gages, 18-17
Diaphragm motors, 18-25
Diaphragms, blow-out, 9-16
turbine, 8-51
Dichlorodifluoromethane (Tables), 11-10, 11-13
Dichloroethylene, 11-10, 11-18
Dichloromethane (Tables), 14-40, 11-10
Dieleene, 11-10
Diesel, Rudolf, 13-02
Diesel combustion chambers, 13-04
Diesel combustion cycles, 13-03
Diesel cycle, compression ratio effects, 13-06
diagrams of operation, 13-03
4-stroke, diagram, 13-03
mean effective pressure, 13-06
mixture ratio effects, 13-06
petrol diagram, 13-02
2-stroke, diagram, 13-03
Diesel-electric locomotives, auxiliaries, 14-38
data (Table), 14-34
horsepower ratings, 14-31
references, 14-45
Diesel-electric switching, operating statistics, 14-43
Diesel engines (def), 13-02
accessories, 13-23
air intake, 13-21
air-starting system, 13-23
bearing wear, 13-39
Diesel engines (continued)
- brake horsepower, 13-14
- brake horsepower guarantees, 13-15
- for bus service, 13-27
- classification, 13-02
- closed cooling systems, 13-23
- clutches, 13-20
- combustion system, care of, 13-36
- compression process in, 13-07
- cooling system, care of, 13-30
- quantity of water, 13-23
- cooling water, 13-22
- Cooper-Bessemer, 18-10
- cost of operating, 13-24
- crankshaft wear, 13-39
- critical speeds, 13-16
- data (Table), 13-17
- dual-fuel (def), 13-03
- duty of, 13-04
- exhaust gas temperatures, 13-12
- exhaust-heat boiler, data (Table), 13-18
- exhaust-heat recovery, 13-12
- exhaust heaters, 13-12
- exhaust systems, 13-21
- exhaust temperature, 13-12, 13-36
- extension shafts, 13-23
- fixed charges, 13-26
- flywheels, 13-23
- foundations, 13-20
- vibration of, 13-21
- fuel consumption of, 13-26
- guarantees, 13-15
- fuel-injection system, care of, 13-39
- fuel-oil for, filtering, 13-22
- piping, 13-22
- gas- (def), 13-02
- vs. gasoline engines, 13-27
- governors, performance, 13-16
- standards, 13-16
- test, 13-39
- heat balance, 13-05, 13-06
- heat recovery, 13-11
- history, 13-02
- horsepower characteristic, 14-29
- ideal efficiency, 13-07
- injection systems, 13-03
- inspection forms, 13-37
- leveling of, 13-21
- load variation, 13-20
- for locomotives, 14-42 (Table); 14-43
- loss of compression in, 13-36
- lubricating oil, consumption, 13-26
- guarantees, 13-15
- systems, 13-22
- systems, care of, 13-36, 13-39
- maintenance forms, 13-37
- marine, 15-81
- oil coolers, 13-22
- open cooling system, 13-23
- operating costs per kilowatthour, 13-26
- operation and maintenance, 13-34
- overload capacity, 13-20
- parallel operation, 13-16
- performance data, 13-30, 13-31
- performance records, 13-35
- piping, 13-21
- piston liner wear, 13-39
- piston and rings wear, 13-39
- plant layout, 13-20
- power and efficiency formulas, 13-05
- power transmissions, 13-20
- precombustion chamber, 13-04
- ratings at altitudes, 13-14
- recovery of jacket-water heat, 13-12

Diesel engines (continued)
- scavenging air, 13-03
- system, care of, 13-36
- selection and installation, 13-16
- selection of sizes, 13-20
- in ships, 15-72
- small, fuel consumption, 13-27
- standard equipment, 13-15
- standards, 13-14
- tolerances in, 13-15
- supercharged, heat balance, 13-10
- supercharging, 13-08
- of four-cycle, 10-04
- test results, 13-01, 13-32
- testing, calculation of results, 13-29
- instruments and apparatus, 13-28
- procedure, 13-28
- thermal efficiency, 13-02
- thermodynamics, 13-05
- torsional vibration, 13-16
- valve timing, 13-39
- wiring for, 13-21

Diesel fuel oils, 13-32
- ash content, 13-33
- carbon residue (def), 13-33
- cetane number, 13-33
- classification, 13-32
- cleanliness, 13-33
- Conradson carbon, 13-33
- flash point, 13-33
- handling systems, 13-22
- ignition quality, 13-33
- injection of, 13-03
- purification, 13-22
- selection, 13-34
- specifications, 13-32
- storage, 13-21
- sulfur in, 13-33

Diesel index, 13-33 *

Diesel locomotives, 14-29
- availability, 14-45
- comparison with steam (Table), 14-44
- costs, 14-45
- dynamic braking characteristics, 14-31
- economics, 14-45
- with hydraulic coupling, 14-40
- mining, 14-40
- reliability, 14-45
- tonnage, 14-45
- wheel arrangements, 14-31

Diesel lubricating oils, 13-34
- characteristics, 13-34
- classification, 13-34
- effect of engine operation on, 13-35
- SAE grades, 13-35
- types, 13-34

Diesel power, ASME cost report, 13-25, 13-26
- economics, 13-24
- Diesel-powered rail car, 14-40, 14-41
- Diesel-steam power plants, 13-13
- Differential calculus, 20-72
- Differential current, 16-36
- Differential current trip, 16-32
- Differentiation formulas (Table), 20-74
- Diffuser efficiency, 3-69
- Diffuser section, centrifugal compressor, 10-40
- Diffusers, subacoustic, 3-69
- superacoustic, 8-60
- thermodynamic relations, 3-68
- two-dimensional, 15-34
- Diffusion, neutron, 17-08
- Dihedral angle, aircraft, 15-23
- Dimensional analysis, 5-04
- Dimensionless parameters, use, 1-112
Dimensions, aircraft engine, 13-52
copper pipe (Table), 6-32
copper wire and cable (Table), 16-07
diesel engine, 13-16
Everdur pipe (Table), 6-32
fly-ash collectors, 7-96
freezing tanks (Table), 11-50
locomotive (Table), 14-09
physical quantities (Table), 5-05
pipe threads (Table), 6-34
seamless steel pipe (Table), 6-25
two-pass surface condensers (Table), 9-14
welded pipe (Table), 6-25

Dimensions and ratings, cast-iron radiators (Table), 12-14

Dimensions and weights, condensing turbine-generator sets (Table), 16-14
turbine-electric locomotive (Table), 14-28
turbo-geared locomotive (Table), 14-26
turbine-generator sets (Table), 16-15

Diminishing-value depreciation, 16-92

Direct-current locomotives, 14-46
Direct-current power transmission, 16-04
Direct-current ship propulsion, 15-78
Direct-fired system, pulverized-coal, 7-86
Directional overcurrent, 16-36
Discharge, coefficient, 1-11, 1-13
elusive gates, 5-11
wears, 5-11

Discharge coefficient, orifices, 1-18

Disco coke, 2-38

Disk, tangential and radial stress in, 8-28
Disk design, turbine, 8-27
Disk friction loss, centrifugal pumps, 5-64
turbines, 8-37
Disk loading, helicopter, 15-26
Disk rotation loss, turbine, 8-37

Disks stresses, Haarle’s method, 8-31
turbine, 8-28

Disk vibration, turbine, 8-36

Disks, shrink fits for turbine, 8-35

Displacement, aircraft engine, 13-52
affective, reciprocating machine, 11-07
engine, 13-05
internal combustion engine (Tables), 13-17, 13-18, 13-19
passenger car engine, 14-61
piston, refrigeration, 11-07
ship, 15-69

Displacement compressors, ASME test code, 19-02

Dissociation of CO₂ and H₂O, 2-73

Dissolved gases in feedwater, 7-50

Dissolved solids in feedwater, 7-50

Distillation range, aviation fuels, 13-50

Distillation temperatures, fuel oil, 2-46

Distilling plants, ship, 15-83

Distributing systems, cooling tower, 9-28

Distribution, general plant electric power, 16-25
overhead electric power, 16-73
power, 16-22

Distribution expense, 16-95

Distribution lightning arresters, 16-40

Distribution plant investment, 16-89 (Table); 16-90

Distribution transformers, 16-89

Diversity factor, 16-12

Dieselpower development, 5-30

Doman Frazier Helicopters, Inc., 15-25

Douglas Aircraft Co., 15-04

Draft, loss in boilers, 7-16
loss in chain-grate stokers, 7-67
loss in economizers, 7-94

Draft (continued)

ship, 15-69

Draft tubes, hydraulic turbines, 5-38

Drag, of cables, 15-15 (see also Resistance)

of flat plates, 15-15
of hemispheres, 15-14
induced, 15-10
interference, airplanes, 15-16
profiles, 15-10
of spheres, 15-14
of streamlined bodies, 15-14
of struts, 15-13
of wires, 15-15

Drain-cooler sections of feedwater heaters, 7-48

Drain-coolers, priming of, 7-49


INDEX
### INDEX

**Efficiency (continued)**
- turbine wheel, 8-71
- volumetric, 1-42 (Chart); 13-05 (def), 13-45 (def)
- wheel, impulse turbines, 8-26

**Ejector, steam-jet air, 1-50, 9-18**
- ASME test code, 19-29
- Ejector condenser, 9-07
- steam capacities, 9-07
- water capacities, 9-07

**Elbows, equivalent length (Table), 6-40**
- flow resistance, 6-36
- pressure loss in air ducts (Table), 12-53

**Electric calorimeter, 7-22**

**Electric controllers, 18-25**

**Electric-drive ships, 15-78**

**Electric locomotives, 14-46** (see also Locomotives, electric)
- data (Table), 14-54
- mechanical construction, 14-56
- method of rating, 14-48
- power circuits, 14-57
- references, 14-40
- resistance formulas (Table), 14-48
- tractive resistance, 14-48

**Electric-motor valves, 18-26**

**Electric power, 16-03**

**Electric transmission systems, locomotive, 14-29**

**Electrical engineering, basic data, 16-03**

**Electrical overload capacity, electrical equipment, 16-33**

**Electrical precipitators for fly ash, 7-06**

**Electrical system, automotive engine, 14-78**

**Electricity, heating by, 12-56**

**Electrodynamic braking, locomotive, 14-30**

**Electromagnetic clutches, 14-39**

**Electron, beta ray, 17-02**

**Electronic inverter, 16-83**

**Electrostatic cleaners, 12-73**

**Elements, nuclear properties (Table), 17-18**

**Elliott-Buchi turbocharger, 13-09**

**Elliott Co., gas turbines, 10-20, 10-30**

**Ellipses, geometry of, 20-57**

**Ellipsoid, geometry of, 20-61**

**Elliptic functions, 20-85**

**Elongation, pipe materials, 6-03**
- tube steel (Table), 6-29

**Embrittlement, caustic, 7-62**

**Emf of thermocouples (Tables), 18-08**

**Emissivity (Table), 3-39**
- carbon dioxide, 3-24
- metallic surfaces, 3-21
- various surfaces, 3-39
- water vapor, 3-24

**End tightening, turbine, 8-07**

**Energy 3-50 (def), 16-90 (def)**
- availability of, 3-53
- available, 4-04
- distribution, from fission, 17-07
- gravitational potential, 3-50
- internal, 3-30
- kinetic, 3-50
- metric equivalents, 20-49
- molecular, 3-50
- photon, 17-02
- stored, 3-50
- units, 3-51

**Energy balance, combustion processes, 2-10**
- gas turbine, 15-44

**Energy equation, 3-04**
- general, 1-11

**Energy gradient, 5-11**

**Energy loss, average logarithmic, 17-09**
INDEX

Energy and mass, equivalence, 17-03
Enforcement of boiler code rules, 7-17
Engine, C.F.R., 14-75
Engine data, aircraft (Table), 13-52
Engine design, automotive, 14-69
Engine details, automotive, 14-62
Engine-driven generators, 10-16
Engine efficiency of turbines, 8-14 (def); 8-57
Engine fuel, vegetable oils as, 2-61
Engine generators, parallel operation, 13-16
  torsional vibration, 16-18
Engine kinematics, automotive, 14-69
Engine lubrication system, 14-08
Engine performance (Table), 10-06
Engine speed, effects of, 13-45
Engine tests, specific, 14-02
Engine water-cooling system, locomotive, 14-39
Engineering & Research Corp., 15-05
Engines, aircraft (Table), 13-52
  aircraft, materials, 13-42
  aircraft, structural components, 13-42
  aircraft piston, 13-40
  automotive, tests, 14-88
  auxiliary systems, 13-48
  combination jet and reciprocating, 15-19
  compound steam, 8-106
  cooling of, 13-51
  cylinder construction, 13-43
  diesel, 13-02
  effect of spark advance, 13-46
  effect of speed, 13-45
  internal-combustion, 13-01
  ASME test code, 19-02
  dimensions, 13-16
  fuel economy, 13-16
  losses, 13-05
  specific output, 13-16
  thermodynamic cycles, 13-06
  large diesel, data (Table), 13-19
  medium diesel, data (Table), 13-18
  opposed-piston, 13-03
  performance characteristics, 13-44
  pistons for, 13-43
  sleeve-valve, 13-44
  small diesel, data (Table), 13-17
  steam, 8-30
  triple expansion, 8-107
  thermal efficiency of, 13-45
  torsional vibration and critical speed, 13-16
  truck, 14-61
  trunk-piston, 13-03
  valves and valve mechanism, 13-43
Engler viscosimeter, 6-43
English propjets (Table), 15-68
English turbojets (Table), 15-67
Enlargements, sudden, in conduits, 5-13
Enthalpy, 3-51 (def); 4-02 (def)
  of evaporation, 3-08
  real gas, 3-39
  steam, 4-02
Entropy, 3-02
  real gas, 3-09
Epicycloid, geometry of, 20-58
Equalization of pipes, 12-36
Equation, continuity, 8-117
  energy, 1-11, 3-64
  Euler's, 5-52
  exponential, solution of, 20-04
  flow, 3-04
  of state, 1-02, 5-02
  Beattie-Bridgeman, 3-57
Equations, flow of fluids, 18-19
  thermodynamic, summary, 3-65
Equilibrium constants, producer gas reactions (Table), 2-89
Equipment for diesel engines, standard, 13-15
Equivalent direct radiation, 12-14
Equivalent evaporation, 7-12
Ericsson regenerative cycle, 10-03, 10-13
Erosion of buckets, 8-26
Escher-Wyss, closed-cycle gas turbine, 10-23
  gas turbines, 10-20
Ethane, combustion, 2-04
  critical-state properties, 3-60
  data, 1-40
Ethanol, 2-59
  freezing point of water solution of, 14-63
  heating value, 2-59
  latent heat, 2-50
  specific gravity, 2-59
Ether, thermal conductivity, 3-15
Ethyl alcohol, combustion, 2-04
Ethyl chloride, data, 1-40
Ethylene, Beattie-Bridgeman constants, 3-57
  combustion, 2-04
  critical-state properties, 3-60
  data, 1-40
  gas constants, 3-54
  specific heat at zero pressure, 3-58
Ethylene glycol, freezing point of water solution of, 14-63
Euler's equation, 1-52, 5-52
Euler's head, 5-52
Euler's velocity triangle, 5-53
Evaporating apparatus, ASME test code, 19-02
Evaporation, actual, in boilers, 7-12
  to atmosphere, 3-81
  enthalpy, 3-09
  equivalent, 7-12
  factor, 7-12
  locomotive boiler, 14-06
  make-up water, 7-57
  multiple-effect, 3-75
  from tanks and reservoirs, 3-81
Evaporative cooling, principles of, 9-20
Evaporators, 3-71
  construction, 3-72
  heat balance equations, 3-78
  heat-transfer, 3-73
  heat-transfer coefficient, 3-75
  make-up, 3-81
  material balance, 3-78
  multiple-effect, calculations for, 3-77
  plant steam-flow diagram, 3-80
  references, 3-82
  refrigeration, 11-47
  thermodynamics, 11-05
  types, 3-72
Everdur pipe (Table), 6-32
Excess air, design values, 2-06
  determination, 2-05
  effect on pulverised-coal combustion, 7-89
Exciter prices, 16-16
Exciter ratings, standard, 16-16
Exciters, a-c generator, 16-16, 16-17
  belted, speeds of (Table), 16-17
Exhaust of diesel engines, 13-21
Exhaust heat boiler, diesel, data (Table), 13-13
Exhaust heat recovery, in diesel engines, 13-12
Exhaust heaters, for diesel engines, 13-12
Exhaust hoods, turbine, 8-52
Exhaust losses, turbines, 8-23, 8-66
Exhaust reheate, in jet propulsion, 15-64
Exhaust steam heating, 12-33
Exhaust temperatures, of diesel engines, 13-12
Exhausters, 1-58
ASME test code, 19-02
INDEX

Expansion of air, 3-09
of gas turbine ducts, 10-45
of gases (Table), 3-11
isentropic work of, 10-02
liquids (Table), 3-11
piping, 3-07
solids (Table), 3-10
steel, thermal, 3-11
thermal, 3-09
Expansion factor data (flow measurement), 1-14
Expansion fan, supersonic flow, 15-32
Expansion line, turbine, 8-68, 8-70
Expansion tanks, hot-water heating, 12-39
Expansion thermometers, 18-02
accuracy of, 18-07
Expansion valves, 11-47
refrigeration, 11-03
thermodynamic relations, 11-05
Expansion waves, supersonic flow, 15-29
Explosion limits, butane and propane, 2-60
Exponential equations, solution, 20-04
Exponential functions, logarithms (Table), 20-24
Extended-surface heaters, 12-57
Extraction calculations, turbine, 8-72
Extraction turbines, 8-10, 8-88, 16-11
Extraction-type steam engines, 8-107

Factor, of adhesion, locomotives, 14-08
of evaporation, 7-12
roughness, 15-07
turbulence, 15-07
Factorials (Table), 20-26
Factors in safety, boiler code, 7-17
Fahrenheit absolute temperature scale, 18-02
Fahrenheit to centigrade, conversion (Table), 18-04
Fahrenheit to Rankine, conversion, 18-02
Fahrenheit temperature (deg), 3-52
Fairbanks Morse diesel engine (Tables), 13-17, 13-18, 13-19
Fan heating systems, 12-44
calculations, 12-45
Fan systems, allowable velocities (Table), 12-50
Fan wheels, proportions, 1-73
Fanning equation, 1-22
Fans, 1-57
arrangement of drive (Table), 1-61
ASHVE code, 1-71
ASME code, 1-71, 19-02
axial-flow, 1-37, 1-58, 1-93 (see also Axial-flow compressors)
characteristics, 1-95
backward-curved blade, 1-72
capacity table, 1-84
basic laws, 1-65
blade characteristics, 1-74
centrifugal, 1-58, 1-72 (see also Centrifugal compressors)
characteristic performance, 1-64
characteristics, 1-77
inlet connections, 1-75
velocity diagrams, 1-74
characteristic curves, 1-64
characteristics, 1-63
control, 1-90, 1-91
corollary laws, 1-65
damper control, 1-91
definitions, 1-92
development tests, 1-70
direction of rotation and discharge (Table), 1-61
dusted, 15-40
efficiency, 1-80
field tests, 1-63

Fans (continued)
fluid drive control, 1-92
forward-curved blade, 1-72
capacity table, 1-82
gas density variation, effect, 1-65
high-speed, dimensions (Table), 1-85
horsepower, 1-80
 housings, 1-74
induced draft, methods of control, 1-92
inlet guide vanes, 1-75
inlet-louver control, 1-91
inlets, 1-74
laws, 1-63, 1-64
examples, 1-67
magnetic drive control, 1-92
methods of testing, 1-60
motor position (Table), 1-62
noise, 1-72
operating characteristics, various blades, 1-72
operating limits, 1-59
outlet areas (Table), 1-60
outlets, 1-76
position of inlet boxes (Table), 1-62
primary characteristics, 1-63
propeller, 1-58, 1-93
capacity table and dimensions, 1-90
characteristic curves, 1-94
radial-blade, 1-72
capacity table, 1-86
dimensions (Table), 1-87
ratings, 1-81
references, 1-57
secondary characteristics, 1-64
selection, 1-80
Sirocco, dimensions (Table), 1-83
size variation, 1-65
sound emission, 1-80
sound measurement tests, 1-72
specifications, typical, 1-63
speed variation, 1-65
standard sizes, 1-60
standards, definitions and terms, 1-58
syston characteristics, 1-68
test codes, 1-71
testing, 1-70
tubaxial, 1-58, 1-93
capacity table, 1-89
dimensions (Table), 1-89
types, 1-57
vanesaxial, 1-58, 1-94
capacity table, 1-88
capacity curves, 1-95
dimensions (Table), 1-88
variable-speed drive, 1-92
ventilating, outlet velocities and tip speeds (Table), 1-81
witness tests, 1-70

Feeder, pulverized-coal, 7-82
Feedwater, analysis, 7-50
chemistry of, references, 7-63
chloride in, 7-50
composition of, 7-50
dissolved oxygen, 7-50
effect of impurities, 7-62
effect of organic matter, 7-51
effect of various chemicals, 7-51
hardness, 7-50
heating of, 7-41
heating systems for, 8-86
impure, effects, 7-62
impurities in boiler (Table), 7-51
oil in, 7-50
pH value, 7-50
pumping of, 7-41
Fixed charges (continued)
in diesel engine operation, 12-36
Flame distribution, oil-burner, 2-63
Flame intensity, 2-74
Flame temperature, of gases, 2-64
Flame velocity, in gas, 2-69
Flames, luminous, 2-65
radiation from, 2-65
Flange facings, 6-09
Flange resistance, train, 14-02
Flange taps (flow measurement), 1-15, 18-19
Flanged fittings, pressure-temperature ratings (Table), 6-10
Flanged joints, 6-09
Flanges, dimensional standards, 6-05
material specifications, 6-04
pressure-temperature ratings, 6-10, 6-11, 6-12, 6-13
welded, 6-14
Flaps, wing, 15-12, 15-13
Flash point, 2-46
diesel fuel oils, 13-33
gases (Table), 2-67
Flat plate airfoil, 15-33
Flat plates, drag, 15-15
Fleigner's equation for flow of air, 1-13
Float chamber carburetor, 13-49
Floating header in closed feedwater heaters, 7-49
Floating rate adjustment, automatic controllers, 18-24
Floating shafts, gas turbine, 10-11
Flow, of air, Fleigner's equation, 1-13
of air in pipes, 1-22
in closed conduits, 5-12
compressible, equations, 6-45
in pipes, 6-44
compressible fluids, 15-28
dam, 6-18
of fluids, equations, 18-19, 18-20
in pipes, 6-35
references, 6-47
with friction, 1-23, 3-67
frictionless, 1-11
of gas, equation, 5-61
incompressible, 1-22
laminar, 1-22
measurement, 1-13
open conduits, 5-12
in pipes, Fritzsche equation, 1-30
Unwin equation, 1-30
Weymouth equation, 1-31
reversible frictionless, 8-65
through short tubes and orifices, 5-09
in tubes, friction factor, 7-16
turbulent, 1-22
of water, in conduits, 5-11
salt-solution method, 5-23
salt-velocity method, 5-22
in steel pipe, 5-16
over weirs, 5-19
Flow arrangement, effect on regenerator effectiveness, 10-44
Flow coefficient, 1-13
orifice (Table), 18-20, 18-21
square-edged orifices, 1-17
Flow control, 18-31
Flow equations, 3-64
Flow equivalents (Table), 20-44
Flow formulas, pipe, 1-24
Flow measurement, area multipliers, 1-14
expansion factor, 1-14
location of orifices in pipe, 1-17
Flow nozzles, ASME, installation, 1-31
ASME standard, 1-19
INDEX

Flow rate, integration of, 18-22
in refrigeration, 11-05
Flow relations, conical shock wave, 15-38
normal shock wave (Table), 15-30
oblique shock wave, 15-31
Flowing water, measurement, 5-19
Flue gas, analysis, wood combustion (Table), 2-41
composition, 2-06
data, 1-40
moisture, 2-08
Flue-gas components, calculation, 2-08
Fluid drive, 5-94
Fluid flow, forces, 5-04
methods of measuring, 18-18
Fluid mechanics, 5-02
Fluid resistance, 15-06
Fluids (dcf), 5-02 (see also name of fluid)
flow, 1-11
references, 6-47
incompressible, equations, 1-11
physical properties, 5-02; 5-03 (Table)
shaping stress within, 5-02
Flutter in aircraft, 15-23
Fly ash, 7-91
centrifugal concentration, 7-95
chemical components (Table), 7-91
composition, 7-91
effect of boiler design, 7-94
effect of boiler load, 7-94
effect of coal type, 7-93
effect of firing methods, 7-92
effect of furnace design, 7-94
electrical precipitators for, 7-95
mechanical removal of, 7-94
physical characteristics, 7-91
from pulverised-coal burners, 7-92
reinjection in furnace, 7-93
from stoker-fired boilers, 7-92
typical screen analysis, 7-90
Fly-ash collectors, 7-94
baffle-type, 7-94
centrifugal, 7-95
coast, 7-96
dimensions, 7-96
Fly-ash concentration, 7-92
Fly-ash emission, ordinances, 7-94
Fly-ash removal, 7-89
electrical, 7-90
mechanical, 7-90
Flywheels, diesel engine, 13-23
Foaming, boiler, 7-83
Foamover, boiler, 7-20
Fuels, dimensions, 5-05
metric equivalents (Table), 20-49
Forced-circulation boilers, 7-08, 7-09
Forced hot-water heating system, 12-37
Forced warm-air heating systems, 12-44
Forces, fluid flow, 5-04
Foundation materials, turbine, 8-52
Foundations, diesel, 15-20, 13-21
turbine, 8-52
Frame construction, thermal conductivity, 12-04
Franklin engines, 13-52
Fredric-Flader, Inc., turbojet, 15-66
Free path, mean, 17-07
Free-piston engine, 13-11
Free-piston gas generator, 10-07, 10-08
Free-piston gas turbine cycle, diagram, 10-08
Free-swelling index, coal, 2-22
Free-vortex flow, compressors, 1-105
Freezers, sharp, 11-52
Freezing, quick, 11-52
Freezing mixtures, 3-09 (Table); 11-02
Freezing point, of aviation fuels, 13-50 (see also Melting points)
Freezing tanks, dimensions (Table), 11-50
Freezing time (Table), 11-48
Freight cars, resistance (Table), 14-03
tractive resistance, 14-48
"Freon-11," 11-10, 11-14
properties (Table), 11-15
"Freon-12" (Tables), 11-10, 11-13
data, 1-40
p-h chart, 11-04
thermal conductivity, 3-15, 3-16
"Freon-12" system, example of calculation, 11-05
"Freon-22," 11-16; 11-17 (Table)
p-h chart, 11-16
Frequency control, 8-49
Frequency converters, electrical, 16-83
Friability of coal and coke, 2-23
Friction, coefficient, closed conduits, 5-16 (see also Friction factor)
fluid flow, 5-09
flow of fluids with, 1-23
pipe, 3-64
skidding coefficient, 14-81
skin, 15-14
Friction effects in gas flow, 3-68
Friction factor, 1-24, 5-07
flow in tubes, 7-16
fluid flow, 6-36
Harris approximation, 1-24
Unwin approximation, 1-24
Weymouth approximation, 1-24
Friction head, 5-12 (see also Pressure drop)
Friction horsepower of engines (def), 13-45
Friction loss in feedwater heaters, 7-47
Friction between tires and road surface (Table), 14-62
Frictionless adiabatic flow of gases, 3-61
Fritzsche equation for flow, 1-30
Froude's number, 5-04, 15-07
Fruits, storage of, 11-40
Fuel-air ratio, effect on engines, 13-46
Fuel-burning equipment, boiler (Table), 7-04
boiler, capacity range (Table), 7-05
pulverised-coal, requirements, 7-87
Fuel characteristics, boiler, 7-03
Fuel consumption, automotive engine, 14-77
engine specific, 13-45
gas engine compressor, 13-56
heating plants, 12-22
for power in U. S. (Table), 16-87
small diesels, 13-27
specific, 13-45
typical internal combustion engines (Tables), 13-17, 13-18, 13-19
Fuel consumption guarantees, diesel engine, 13-15
Fuel costs, diesel engine, 13-25
Fuel economy, diesel engine, 13-26
internal-combustion engine, 13-16
Fuel-handling systems, diesel engine, 13-22
Fuel injection, aircraft engine, 13-49
Fuel-oil filtering, diesel, 13-22
Fuel-oil piping, diesel, 13-22
Fuel oils, advantages, 2-50
analysis (Table), 2-48
characteristics, 2-45
characteristics of marine (Table), 15-72
diesel, 13-29
classification, 13-32
heating value, 2-48
requirements (Table), 2-46
specifications, 2-46
Fuel rate, gas turbine, 10-11 (see also Fuel consumption)
INDEX

Fuel rate (continued)
gas turbine, effect of pressure drop, 10-17
Fuel saving by air preheaters, 7-36
Fuel storage, diesel engine, 13-21
Fuel system, automotive engine, 14-78
Fuel testing procedures, automotive, 14-75
Fuels, 2-01 (see also name of fuel)
  aircraft, 13-50
  auxiliary, characteristics, 2-85
  costs (Table), 2-85
  aviation, data, 13-50
  specification, 13-50
  and combustion, automobile, 14-74
  comparative analyses and heating values (Table), 2-13
  comparison, 2-12
  gas engine compressor, 13-56
  gas producer, 2-88
  gasus, 2-61 (see also name of fuel)
  references, 2-86, 2-87
  heating value (Tables), 2-04, 2-16 (see also name of fuel)
  hogged, 2-39, 2-40
  jet propulsion, 15-62
  justifiable price, 2-15
  liquid, 2-45 (see also name of fuel)
  ASME test code, 19-03
  composition (Table), 2-05
  heating value (Tables), 2-05, 2-48
  miscellaneous, 2-59
  preparation, 2-52
  references, 2-61
  knock-rating reference, 14-75
  packaged, 2-43
  relative economy, 2-12
  ship, 15-72
  solid, 2-17 (see also name of fuel)
  ASME test code, 19-03
  calorific value determination, 2-21
  typical value determination, 2-14, 2-17
  waste, 2-44
Furnaces (def), 7-91
Funk Aircraft Co., 15-05
Fur storage, refrigeration requirements, 11-43
Furnace arches, 7-65
  construction, 7-78
Furnace atmospheres, 2-85
Furnace bottoms, 7-80
  factors affecting, 7-80
Furnace design, 7-74
  effect on fly ash, 7-94
Furnace floors, 2-54
Furnace heat release, 2-37; 7-04 (Table)
Furnace ratings, gravity warm-air, 12-42
Furnace refractory, desired properties, 7-78
Furnace temperature, allowable, 7-75
  factors affecting, 7-75
Furnace volume, 7-75
Furnace walls, 7-10
  air-cooled refractory, 7-77
  attached block, 7-79
  bare-plat, 7-78
  bare-tube, 7-78
  clinker belt construction, 7-76
  construction of horizontal-return tubular boiler, 7-76
  covered tube, 7-79
  heat loss and heat capacity of (Table), 3-49
  integral block, 7-79
  manufacturers, 7-81
  refractory, 7-76
  heat-release rates for (Table), 7-75
  joints, 7-77
  stud type, 7-80
Furnace walls (continued)
types, 7-75
  water-cooled fin-tube, 7-79
  heat-release rates (Table), 7-75
  water-cooled metal, 7-78
Furnaces, boiler, 7-63
  references, 7-82
  dry-bottom, 7-81
  slag-tap, 7-81
  slagging, 7-81
  wet-bottom, 7-81
Fuses, high-voltage, 16-29
  inverse-time characteristic, 16-32
  short-circuit in (Table), 16-29
Fusion, 3-07
  latent heats of (Table), 3-09

G. M. Cleveland diesel engine, 13-18, 13-19
G. M. Detroit diesel engine, 13-18
G. M. Electromotive diesel engine, 13-19
Gage, absolute-pressure, 18-17
  bellows, 17-18
  Bourdon and other types, 19-11
  Bourdon-tube, 18-17
  deadweight, 19-11
  diaphragm, 18-17
  liquid-level, 18-18
  pressure, 18-15
  wire (Table), 16-08
Galium, nuclear properties, 17-18
Gallon, British Imperial, 20-44
  equivalents (Table), 20-44
  U. S., 20-44
Gamma rays, 17-02
Gas, analysis of, 2-61 (see also Gases and name of gas)
  blue, 2-77
  density of, 2-75
  heat-release rates, 7-75
  isentropic change, 5-02
  isothermal change, 5-02
  molar volume, 2-03
  oil, 2-64, 2-82
  polytropic change, 5-02
  producer, 2-64, 2-77
  volume correction, 2-76
  weight rate of discharge, 3-61
Gas burners, 7-71
  boiler capacity range of, 7-05
  manufacturers, 7-72
Gas calculations, 2-75
Gas combustion, references, 2-36, 2-87
Gas compression, power for, 1-46
  power required (Chart), 13-57
Gas constant, perfect gases (Table), 3-54 (see also name of gas)
  universal, 5-02
Gas-diesel, 13-02
Gas-electric cars, 14-40
Gas engine compressors, 13-55
  compression pressure, 13-58
  cooling systems, 13-58
  fuel consumption, 13-56
  fuels, 13-56
  governing and control, 13-56
  ignition systems, 13-56
  ratings, 13-56
Gas engines, 13-55
Gas equation, 3-04
Gas-flame velocity, 2-69
Gas flow equation, 3-61
Gas generator-turbine system, 10-06
Gas-house coke, 2-38
Gas inflammability, 2-66
Gas law, 1-02, 5-02
Gas mixture, density, 2-75
Gas oil, heating value, 2-05
Gas producers, 2-87
ASME test code, 19-02
auxiliary equipment, 2-92
fuel for, 2-88
reaction sones, 2-87
references, 2-93
Gas properties, zero pressure, 3-58 (see also name of gas)
Gas tables, development of, 1-02
Gas temperatures, in industrial furnaces, 7-39
Gas transmission lines, 1-31
Gas turbine and compressor matching, 10-37
Gas turbine cycle, compound, 10-04
free piston, diagram, 10-08
ideal, 10-02
thermal efficiency, 10-11
Gas turbine disks, thermal stresses, 10-33, 10-34
Gas turbine ducts, 10-45
Gas turbine locomotive, advantages and disadvantages, 10-25
cost burning, 10-27
efficiency, 10-26
fuel consumption, 10-26
part-load performance, 10-18
power plants for, 10-25
Gas turbine plants, qualitative comparison (Table), 10-19
Gas turbine power plant (def), 10-09
starting
Gas turbine superchargers, 10-04, 13-08
Gas turbines, 10-01 (see also Jet propulsion)
aftercooler (def), 10-09
aircraft (Table), 15-66
air rate, 10-11
effect of pressure ratio, 10-13, 10-15
effect of regenerator effectiveness, 10-13
effect of turbine inlet temperature, 10-13, 10-15
applications, 10-04, 10-19
back-work ratio, 10-11
bearings, 10-36
blade attachments, 10-34
blades, cooling, 10-32
fatigue failure, 10-34
flow pattern, 10-32
blading manufacture, 10-34
blading materials, 10-34
British gunboat, 10-29
characteristic curves, 10-37
closed cycle (def), 10-11
combustion chamber, 15-55
combustors, 10-40
range of operation, 10-42
requirements, 10-41
types, 10-42
comparison with other prime movers, 10-22
component efficiencies, 10-14
components, 10-31
compressor characteristics, 10-37
compressors for, 10-36
compressor types (Table), 10-20
control, 10-20 (Table); 10-46
cycle designation, 10-12
cycle diagrams, 10-10
design criteria, 10-33
design and performance data (Table), 10-20
duct work, 10-45
effect of altitude, 10-16
effect of density, 10-16
effect of pressure loss, 10-17
effect of temperature, 10-16
 Gas turbines (continued)
efficiency, effect of compressor inlet temperature, 10-16
effect of cycle arrangement, 10-13, 10-15
effect of machine efficiency, 10-14
effect of pressure ratio, 10-13, 10-15
effect of regenerator effectiveness, 10-13
effect of turbine inlet temperature, 10-13, 10-15
sensitivity to component efficiency change, 10-16
Elliott marine, 10-31
energy balance, 16-44
Escher Wyss vs. Sulzer cycle, 10-24
floating shaft, 10-11
fuel rate, 10-11 (def); 10-20 (Table)
effect of pressure drop, 10-17
General Electric, 10-29
heat exchangers, 10-43
ideal thermal efficiency, 10-03
intercoolers, 10-43
lubrication, 10-36
manufacturers (Table), 10-20
marine, 10-29
materials, 10-32
creep and rupture data, 10-33, 34
modified cycle efficiencies, 15-44
net useful work, 10-02
open cycle (def), 10-11
operation, 10-45
output of, effect of compressor inlet temperature, 10-16
effect of pressure drop, 10-17
parasitic losses, 10-12
part-load operation, 10-18
performance characteristics, 10-11
performance ratios, 10-16
power generation, 10-02
power output, 15-48
pressure ratio, 10-11
for process heat, 10-22
ratings (Table), 10-21
references, 10-47
regenerator effectiveness, 10-11
regenerator surfaces, 10-44
sq ft/hp, 10-44
regenerators, 10-43
economics of, 10-43
power, hp/ib/sec, 10-44
seals, 10-36
semiclosed cycle (def), 10-11
series-flow arrangement, 10-11
series-parallel flow arrangement, 10-11
shutdown of, 10-46
significant material properties, 10-38
single-shaft, 10-11
starting of, 10-45
Sulzer semiclosed cycle, 10-23
thermal efficiency, 10-11
data, 10-12
thermodynamics, 10-02
turbines for (Table), 10-20
typical, component specifications (Table), 10-20
with waste-heat boilers, 10-22
Westinghouse, 10-29
work ratio, 10-11
effect of pressure ratio, 10-15
effect of turbine inlet temperature, 10-15
Gaseous fuels, ASME test code, 19-02
Gases, combustion, properties, 2-03 (see also Gas and name of gas)
commercial, properties (Table), 2-64
equation for flow, 18-20
INDEX

Gases (continued)
expansion (Table), 3-11
flow, 1-10
fuel, density, Table, 2-62
specific volume, 2-62
heat of combustion (Table), 2-62 (see also name of gas)
industrial, 2-77
liquefied petroleum, 2-60
mixtures of perfect, 3-54
molar specific heats (Table), 2-10
molecular weight, 3-54
perfect, 3-53
gas constant (Table), 3-54
pressure drop in pipe, 6-41
properties of (Table), 1-40 (see also name of gas)
real, 3-57
removal from feedwater, 7-43
sensible heat, 2-74
specific heat (Table), 3-05, 3-54, 3-58
specific heat ratio (Tables), 3-05, 3-54
thermal conductivity, 3-15
thermodynamic charts, list of, 15-57
Gaskets, pipe flange, 6-09
for pressure piping, 6-06
Gasoline, 2-57
characteristics (Table), 2-58
composition, 2-58
explosive mixtures, 2-58
gum content, 14-74
heating value, 2-05
heating value and properties (Tables), 2-59, 14-74
physical properties, 2-58
properties (Tables), 2-59, 14-74
thermal conductivity, 3-15
Gasoline engines, typical data, 13-17
Gasoline engines vs. diesels, 13-27
Gate valves, pressure loss, 6-39
Gear pumps, 5-77
Geared turbine-generator sets, 16-14
Geared-turbine locomotive, 14-24
Geared-turbine units, efficiencies of marine, 15-80
ship, 15-79
Geared turbines, efficiency (Table), 8-62
Gearing, reduction, 8-44
Gears, articulated design, 15-75
efficiency of reduction, 8-44
locked-train, 15-77
nested-type, 15-75
propeller reduction, 13-44
reduction, ship, 15-73; 16-76 (Table)
General Electric gas turbines, 10-20, 10-28, 10-29
General Electric turbojet, 15-66
General Motors (see G. M.)
General plant investment, 16-90
Generated power, 16-11
Generating-plant investment, 16-89
Generator voltage, effect of motor starting, 16-18
Generators, voltage regulators, 16-20
application limits (Table), 16-21
Generators, diesel engine, correction for losses in, 13-29
engine-driven, 16-16
field rheostat for, 19-17
high-speed, weights and dimensions (Table), 16-19
losses, 8-49
low-speed, 10-16
efficiency, 10-17
weights and dimensions (Table), 16-19
maximum ratings, belt-drive (Table), 16-16
in parallel, regulation, 16-32
reversing-armature turbine, 16-14
Generators (continued)
reversing-field turbine, 16-13
speed ratings, 80-cycle, 16-16
standard ratings, 16-14
asynchronous speed, 5-27
temperature rise, 16-14
turbine-driven, 16-13
voltage ratings of engine-driven, 16-16
Geometric figures, plane (Table), 20-55
solid (Table), 20-59
Geometry, 20-50
analytic, 20-62
Germanium, nuclear properties, 17-18
Gibbs' psi function, 3-55
Gibbs' zeta function, 3-55
Gibson method, flow of water, 5-22
Giands, turbine, carbon ring, 8-42
water, power required, 8-43
in turbines, 8-43
Glass, thermal conductivity, 3-14
Glass blocks, heat gain (Table), 12-78
Glenn L. Martin Co., 15-04
Gilders, 15-02
Globe valves, pressure loss, 6-39
Glycerin, thermal conductivity, 3-15
Gold, emissivity, 3-21
nuclear properties, 17-19
thermal conductivity, 3-14
Governing, of compressors, 1-47 (see also Governors)
Governing and control, gas engine compressors, 13-56
Governors, ASME test code, 19-03
diesel, standard performance, 13-16
diesel engine, 13-16
test of, 13-29
hydraulic turbine, 5-43
isochronous, 13-16
mechanical oil relay, 8-48
nonisochronous, 13-16
overspeed, 5-40
pressure-regulating, 8-48
turbine, 8-48
turboalternator, regulation of, 8-48
Grade, classification of coal by, 2-19
Grade resistance, train, 14-03
Gradient, energy, 5-11
hydraulic, 5-11
standard atmospheric temperature, 15-06
Gram-calorie, 3-42
Grand Coulee Plant, 5-30
Graphite, chain, in pipe, 6-15
combustion, 2-04
nodular, in pipe, 6-15
Graphitization of pipe, 6-15
Grashof number, 3-17
Grates, coal, 2-34
dump, 7-69
hand-fired, 7-63
Gravity, specific, oils, 2-47 (see also Specific gravity)
Gravity heating systems, one-pipe, 12-25
special, 12-26
two-pipe, 12-26
Gravity hot-water systems, size of basement mains (Table), 12-35
size of branches and risers (Table), 12-36
Gravity warm-air furnace ratings, 12-42
Grindability of coal, 2-22; 7-84 (Table)
Grindability determination, pulverised coal, 7-83
Grinders, clinker, 7-69
Grinding of coal, principles of, 7-82
Ground overcurrent, 16-37
Grounding, of electrical equipment, 16-39
Grummam Aircraft Engineering Corp., 15-04
Guided missiles, 15-02
Gum content, aviation fuel, 13-50
Gypsum, thermal conductivity, 12-05

Hacrie's method, disk stresses, 8-31
Half-life, radioactive substances, 17-05
Hallett diesel engine, 13-17
Hand-fired grate, 7-63
Hardgrove grindability index, 7-83
Hardness, of tube steel (Table), 6-29
water, 7-54
Harmschfeger diesel engine, 13-18
Harris equation for flow in pipes, 1-24
Hastelloy B, 15-52
Head, dimensions, 5-05
Euler's, 5-52
methods of measuring, 18-18
velocity, 5-11
Head loss, in pipe fittings, 6-36
in valves, 6-39
Head water, measurement of flow by, 18-19
Heat, 3-01
latent, 3-07 (see also Latent heat)
machine equivalent of, 3-02
molal specific, 2-98 (see also Specific heat)
specific, 3-03
total (def), 3-51
units of, 3-02
Heat balance, boiler, 7-12, 7-13
combustion processes, 2-10
diesel engine, 13-05, 13-06
short-cut methods for turbine, 8-72
steam power plant, 8-72
supercharged diesel engine, 13-10
Heat capacity of gases (Table), 2-10 (see also name of gas)
Heat of combustion, aviation fuels, 13-50 (see also name of fuel)
Heat content (def), 3-51
Heat emission, radiator, 12-16
Heat exchange, 3-01 (see also Heat transfer)
Heat exchangers, cross-flow correction factor, 3-31
gas turbine, 10-43
Heat flow through walls, 12-03
Heat gain, equivalent temperature differentials (Table), 12-79
glass blocks (Table), 12-78
solar and sky radiation (Table), 12-78
walls (Table), 12-80
Heat insulation, 3-34 (see also Insulation)
Heat insulation materials (Table), 3-35
Heat loss, bare surfaces, 3-42 (see also Heat transfer)
boiler, 7-13
from buildings, 12-02
calculation method, 12-11
combustion, short-cut method, 2-11
pipe (Table), 3-43
pipe insulation (Table), 3-46
piping system, 12-20
vertical surfaces (Table), 3-40
Heat-power engineering, references, 3-63
Heat pump installations, data, 12-68
Heat pump systems, in office buildings, 12-67
Heat pumps, 12-61
advantages, 12-66
air-to-air design, 12-62
basic design, 12-62
comparison of design features, 12-65
heat sources, 12-65
industrial applications, 12-67
Heat pumps (continued)
liquid-to-air design, 12-63
references, 12-70
water heater, 12-66
Heat rate, nonextraction, 8-78
turbine, estimation, 8-72
Heat rates, test code, 15-25
theoretical nonextraction (Table), 8-73
theoretical percentage reductions in nonextraction (Table), 8-73
Heat recovery, diesel engine, 13-11
Heat-recovery equipment, selection, 7-06
Heat release, furnace, 2-37
oil (Table), 2-54
Heat-release rates, boiler (Table), 7-75
effect of ash, 7-78
effect of excess air, 7-76
effect of firing method (Table), 7-75
effect of furnace wall type (Table), 7-75
Heat released from adults at rest, 12-11
Heat required for drying (Table), 3-82
Heat saving, locomotive feedwater heaters (Table), 14-21
Heat sources in a space, refrigeration, 11-40
Heat transfer, boiler tube banks, 7-15 (see also Heat transmission)
boiler, 7-14
boiling liquids, 3-26
condensing vapors, 3-27
economics, 3-22
evaporators, 3-73
at exposed surfaces, 3-38
feedwater heaters, 7-46
finned surface, 3-28
overall rate, in boilers, 7-15
references, 3-34
warm surfaces in still air (Table), 3-30
Heat-transfer coefficients, composite walls, refrigeration (Table), 11-38
refrigeration coils, 11-44
surface condenser, 9-08
surfaces in water (Table), 3-18
Heat-transfer equations for boilers, 7-15
Heat-transfer processes, fundamental, 3-12
Heat-transfer rates, air preheater, 7-38
boiler, 7-16
economizer, 7-34
superheater, 7-27
Heat transmission, 3-12 (see also Heat transfer)
building construction (refrigeration), 11-36
flow across tubes, 3-19
gas flow across tube banks, 3-19
gas flow over plane surfaces, 3-19
gases in coils, 3-19
gases in tubes, 3-18
liquids in coils, 3-20
liquids in pipes, 3-19
overall coefficient, 12-03
refrigeration, 11-36
Heaters, Aerolite (Table), 12-49
air, 7-34
blast, 12-47
extended-surface, 12-47
gas turbine (def), 10-09
indirect, 12-47
open, construction, 7-45
selection of feedwater, 8-82
unit, 12-13
Vento (Table), 12-48
Heating, 12-02
direct steam, 12-24
by electricity, 12-56
exhaust steam, 12-33
fan or blast, 12-14
INDEX

Horsepower (continued)
steam engine indicated, 8-102
steam locomotive, 14-04
of various locomotive types, 14-25
Horsepower characteristic, diesel engine, 14-29
Horsepower chart, compressor, 15-57
Horsepower-hour, 3-51
Horsepower ratings, diesel-electric locomotive, 14-31
Hot-cathode rectifiers, 16-82
Hot lime-soda process, 7-55
Hot reserve (def), 10-100
Hot surfaces, insulation of, 3-42 (see also Insulation)
Hot water demand, building, estimating, 12-17
Hot-water heating, direct, 12-34
forced system, 12-37
gravity system, 12-34
piping systems, 12-37
Hot-water supply load, 12-16
Hot-water systems, one-pipe forced, main size (Table), 12-38
Hotels, refrigeration requirements, 11-43
Houdry process, 10-02, 10-09
Hull machinery, slip, 15-82
Humidification, 12-74
Humidifying efficiency, 12-75
Humidity, 12-74
for cold storage, 11-42
control of, 11-42
relative, 1-07, 12-74
specific, 1-07
and temperature, relation between, 12-72
Humidity tables for drying calculations (Table), 3-83
Hydraulic compressors, 1-49
Hydraulic controllers, 18-27
Hydraulic couplings, 5-84
constant-speed drive, 5-84
diesel locomotive, 14-40
variable-speed drive, 5-84
Hydraulic gradient, 5-11
Hydraulic Institute Test Code, 5-50
Hydraulic losses, centrifugal pump, 5-61
Hydraulic prime movers, ASME test code, 19-02
Hydraulic radius (def), 5-09, 6-35
dimensions, 5-05
Hydraulic ram, 5-83
Hydraulic turbines, 5-23
buckets, 5-41, 5-42
casings, 5-35
cavitation, 5-37
determination of speed, 5-29
draft tubes, 5-39
fundamental equations, 5-24
governors, 5-43
impulse, 5-23, 5-26
Kaplan, 5-27, 5-29
largest capacities, 5-30
model runner tests, 5-31
needle nozzle, 5-43
profile of runner buckets, 5-32, 5-35
reaction, 5-28, 5-27, 5-28
references, 5-49
regulation, 5-43
runaway speed, 5-36
runner proportions, 5-32
selection of type, 5-26, 5-28
settings, 5-29
speed regulation, 5-43
testing, 5-48
theory of impulse, 5-40
thrust bearings, 5-36
Hydraulics, 5-09

Horsepower (continued)
steam engine indicated, 8-102
steam locomotive, 14-04
of various locomotive types, 14-25
Horsepower characteristic, diesel engine, 14-29
Horsepower chart, compressor, 15-57
Horsepower-hour, 3-51
Horsepower ratings, diesel-electric locomotive, 14-31
Hot-cathode rectifiers, 16-82
Hot lime-soda process, 7-55
Hot reserve (def), 10-100
Hot surfaces, insulation of, 3-42 (see also Insulation)
Hot water demand, building, estimating, 12-17
Hot-water heating, direct, 12-34
forced system, 12-37
gravity system, 12-34
piping systems, 12-37
Hot-water supply load, 12-16
Hot-water systems, one-pipe forced, main size (Table), 12-38
Hotels, refrigeration requirements, 11-43
Houdry process, 10-02, 10-09
Hull machinery, slip, 15-82
Humidification, 12-74
Humidifying efficiency, 12-75
Humidity, 12-74
for cold storage, 11-42
control of, 11-42
relative, 1-07, 12-74
specific, 1-07
and temperature, relation between, 12-72
Humidity tables for drying calculations (Table), 3-83
Hydraulic compressors, 1-49
Hydraulic controllers, 18-27
Hydraulic couplings, 5-84
constant-speed drive, 5-84
diesel locomotive, 14-40
variable-speed drive, 5-84
Hydraulic gradient, 5-11
Hydraulic Institute Test Code, 5-50
Hydraulic losses, centrifugal pump, 5-61
Hydraulic prime movers, ASME test code, 19-02
Hydraulic radius (def), 5-09, 6-35
dimensions, 5-05
Hydraulic ram, 5-83
Hydraulic turbines, 5-23
buckets, 5-41, 5-42
casings, 5-35
cavitation, 5-37
determination of speed, 5-29
draft tubes, 5-39
fundamental equations, 5-24
governors, 5-43
impulse, 5-23, 5-26
Kaplan, 5-27, 5-29
largest capacities, 5-30
model runner tests, 5-31
needle nozzle, 5-43
profile of runner buckets, 5-32, 5-35
reaction, 5-28, 5-27, 5-28
references, 5-49
regulation, 5-43
runaway speed, 5-36
runner proportions, 5-32
selection of type, 5-26, 5-28
settings, 5-29
speed regulation, 5-43
testing, 5-48
theory of impulse, 5-40
thrust bearings, 5-36

Horsepower (continued)
steam engine indicated, 8-102
steam locomotive, 14-04
of various locomotive types, 14-25
Horsepower characteristic, diesel engine, 14-29
Horsepower chart, compressor, 15-57
Horsepower-hour, 3-51
Horsepower ratings, diesel-electric locomotive, 14-31
Hot-cathode rectifiers, 16-82
Hot lime-soda process, 7-55
Hot reserve (def), 10-100
Hot surfaces, insulation of, 3-42 (see also Insulation)
Hot water demand, building, estimating, 12-17
Hot-water heating, direct, 12-34
forced system, 12-37
gravity system, 12-34
piping systems, 12-37
Hot-water supply load, 12-16
Hot-water systems, one-pipe forced, main size (Table), 12-38
Hotels, refrigeration requirements, 11-43
Houdry process, 10-02, 10-09
Hull machinery, slip, 15-82
Humidification, 12-74
Humidifying efficiency, 12-75
Humidity, 12-74
for cold storage, 11-42
control of, 11-42
relative, 1-07, 12-74
specific, 1-07
and temperature, relation between, 12-72
Humidity tables for drying calculations (Table), 3-83

Hydraulic compressors, 1-49
Hydraulic controllers, 18-27
Hydraulic couplings, 5-84
constant-speed drive, 5-84
diesel locomotive, 14-40
variable-speed drive, 5-84
Hydraulic gradient, 5-11
Hydraulic Institute Test Code, 5-50
Hydraulic losses, centrifugal pump, 5-61
Hydraulic prime movers, ASME test code, 19-02
Hydraulic radius (def), 5-09, 6-35
dimensions, 5-05
Hydraulic ram, 5-83
Hydraulic turbines, 5-23
buckets, 5-41, 5-42
casings, 5-35
cavitation, 5-37
determination of speed, 5-29
draft tubes, 5-39
fundamental equations, 5-24
governors, 5-43
impulse, 5-23, 5-26
Kaplan, 5-27, 5-29
largest capacities, 5-30
model runner tests, 5-31
needle nozzle, 5-43
profile of runner buckets, 5-32, 5-35
reaction, 5-28, 5-27, 5-28
references, 5-49
regulation, 5-43
runaway speed, 5-36
runner proportions, 5-32
selection of type, 5-26, 5-28
settings, 5-29
speed regulation, 5-43
testing, 5-48
theory of impulse, 5-40
thrust bearings, 5-36

Hydraulics, 5-09
<table>
<thead>
<tr>
<th>Index</th>
<th>Indicated horsepower (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>engine (def), 13-45</td>
</tr>
<tr>
<td></td>
<td>in refrigeration, 11-07</td>
</tr>
<tr>
<td></td>
<td>steam engine, 8-102</td>
</tr>
<tr>
<td></td>
<td>Indicator cards, reciprocating compressor, 1-43</td>
</tr>
<tr>
<td></td>
<td>Indicator solutions, colorimetric (Table), 7-53</td>
</tr>
<tr>
<td></td>
<td>Indirect heaters, 12-47</td>
</tr>
<tr>
<td></td>
<td>Indium, nuclear properties, 17-18</td>
</tr>
<tr>
<td></td>
<td>Induced drag, 10-10</td>
</tr>
<tr>
<td></td>
<td>Inducer section, centrifugal compressor, 10-40</td>
</tr>
<tr>
<td></td>
<td>Inductance of a line, 16-03</td>
</tr>
<tr>
<td></td>
<td>Induction motor-generator sets, characteristics (Table), 16-77</td>
</tr>
<tr>
<td></td>
<td>Induction motors, power-factor, 16-46</td>
</tr>
<tr>
<td></td>
<td>recommended capacitor rating (Table), 16-47</td>
</tr>
<tr>
<td></td>
<td>Industrial diesel-electric locomotives, 14-38</td>
</tr>
<tr>
<td></td>
<td>Industrial electric locomotives (Table), 14-59</td>
</tr>
<tr>
<td></td>
<td>Industrial furnaces, waste-gas temperatures (Table), 7-39</td>
</tr>
<tr>
<td></td>
<td>Industrial gases, 2-77 (see also name of gas)</td>
</tr>
<tr>
<td></td>
<td>Inertia forces, automotive engine, 14-71</td>
</tr>
<tr>
<td></td>
<td>locomotive reciprocating parts, 14-22</td>
</tr>
<tr>
<td></td>
<td>Infiltration, air-change method, 12-11</td>
</tr>
<tr>
<td></td>
<td>calculation of, refrigeration, 11-38</td>
</tr>
<tr>
<td></td>
<td>crackage method, 12-11</td>
</tr>
<tr>
<td></td>
<td>heat loss, hyd.-2-02, 12-10</td>
</tr>
<tr>
<td></td>
<td>for windows of various types (Table), 12-10</td>
</tr>
<tr>
<td></td>
<td>Inflammability, gas, 2-66</td>
</tr>
<tr>
<td></td>
<td>of gases, references, 2-86, 2-87</td>
</tr>
<tr>
<td></td>
<td>limits of, calculation, 2-68</td>
</tr>
<tr>
<td></td>
<td>gases and vapors (Table), 2-67</td>
</tr>
<tr>
<td></td>
<td>Injection systems, diesel, 13-03</td>
</tr>
<tr>
<td></td>
<td>Injector, automatic, 7-41</td>
</tr>
<tr>
<td></td>
<td>boiler feeding, 7-41</td>
</tr>
<tr>
<td></td>
<td>locomotive steam, 14-20</td>
</tr>
<tr>
<td></td>
<td>positive-type, 7-41</td>
</tr>
<tr>
<td></td>
<td>principle of operation, 7-41</td>
</tr>
<tr>
<td></td>
<td>Sellers (Table), 7-41</td>
</tr>
<tr>
<td></td>
<td>thermal efficiency, 7-41</td>
</tr>
<tr>
<td></td>
<td>typical data (Table), 7-41</td>
</tr>
<tr>
<td></td>
<td>Inorganic compounds, boiling points (Table), 3-07</td>
</tr>
<tr>
<td></td>
<td>melting points (Table), 3-07</td>
</tr>
<tr>
<td></td>
<td>Instability of turbosolvers, 1-52</td>
</tr>
<tr>
<td></td>
<td>Installation, condenser tube, 9-12</td>
</tr>
<tr>
<td></td>
<td>diesel engine, 13-16</td>
</tr>
<tr>
<td></td>
<td>jet propulsion, 15-61</td>
</tr>
<tr>
<td></td>
<td>Instantaneous overcurrent, 16-35</td>
</tr>
<tr>
<td></td>
<td>Instrument transformers, 16-73</td>
</tr>
<tr>
<td></td>
<td>Instrumentation, 18-01</td>
</tr>
<tr>
<td></td>
<td>plant layout, 18-33</td>
</tr>
<tr>
<td></td>
<td>process, 18-32</td>
</tr>
<tr>
<td></td>
<td>references, 18-22</td>
</tr>
<tr>
<td></td>
<td>transmission, 18-30</td>
</tr>
<tr>
<td></td>
<td>Instrumentation diagram symbols (Table), 18-34</td>
</tr>
<tr>
<td></td>
<td>Instrumenting a process, method, 18-35</td>
</tr>
<tr>
<td></td>
<td>Instruments and apparatus bulletins, ASME, 19-03</td>
</tr>
<tr>
<td></td>
<td>Insulating boards, conductivity, 11-37, 12-06</td>
</tr>
<tr>
<td></td>
<td>Insulating effect, air spaces, 3-30</td>
</tr>
<tr>
<td></td>
<td>Insulating materials (Table), 11-37 (see also Insulation)</td>
</tr>
<tr>
<td></td>
<td>conductivity (Table), 12-04</td>
</tr>
<tr>
<td></td>
<td>electrical conductivity, 12-08</td>
</tr>
<tr>
<td></td>
<td>Insulation, asbestos, 3-35 (see also Heat transmission)</td>
</tr>
<tr>
<td></td>
<td>of cold surfaces, 3-41</td>
</tr>
<tr>
<td></td>
<td>commercial sizes, 3-42</td>
</tr>
<tr>
<td></td>
<td>economic secondary surface, 3-33</td>
</tr>
<tr>
<td></td>
<td>economic thickness, 3-32, 3-44 (Chart)</td>
</tr>
<tr>
<td></td>
<td>of flat surfaces, temperature drop (Table), 3-45</td>
</tr>
<tr>
<td></td>
<td>of gas turbine ducts, 10-45</td>
</tr>
<tr>
<td></td>
<td>heat, 3-34</td>
</tr>
<tr>
<td></td>
<td>heat loss with, 3-43</td>
</tr>
<tr>
<td></td>
<td>heat transfer through, references, 3-49</td>
</tr>
</tbody>
</table>
INDEX

Insulation (continued)
  high-temperature, 3-48
    thermal conductivity (Table), 3-38
  of hot surfaces, 3-42
  loose, conductivity, 11-37
  metallic sheet, 3-35
  mineral wool, 3-35
  molded powder, 3-35
  references, 3-34, 3-49
  underground steam mains, 3-44
  use of, 3-48
  vegetable or animal fiber, 3-34
Insulation thickness practice (Table), 11-41
Insulators, thermal conductivity, 3-36
Intake duct, turbojet, 15-51
Integral block furnace walls, 7-79
Integral calculus, 20-77
Integral economizers, 7-31
Integral superheaters, 7-24
Integrals (Table), 20-78
  definite, 20-85
Integration, irrational functions, 20-77
  by parts, 20-77
  rational fractions, 20-77
Intercondensers, steam-jet ejector, 9-17
Intercoolers, compressor, 1-54
  cooling water requirements, 1-55
  gas turbine, 10-43
  definition, 10-69
Intercooling, compressor, 1-41
  maximum saving with, 1-42
Interdeck superheater, 7-25
Interest, on money, 16-94
Interference drag, airplane, 15-16
Internal-combustion cycles, thermal efficiency vs.
  compression ratio, 13-96
Internal-combustion engines, 13-01 (see also Engines)
  data, 13-16
Internal-combustion stations, unit investment
  cost, 16-90
Internal efficiency, turbine, 8-66
Internal energy, 3-50
  real gas, 3-59
International Harvester diesel engine, 13-17, 13-18
International temperature scale, 18-02
Interrupting rating, protective devices, 16-28
Interstage passage, centrifugal compressor, 10-40
Inverse-time characteristic, fuses, 16-32
Inverse-time overcurrent, 16-33
Inverters, mechanical and electronic, 16-83
Investment, distribution-plant, 16-89 (Table)
  16-90
  overall-plant (Table), 16-89
  power plant, 16-89
  production-plant (Table), 16-89
  signal-system, 16-90
  street-lighting, 16-90
  substation, 16-09
  transmission-line, 16-90
  transmission-plant, 16-90
  transmission substitution, 16-90
  Iodine, nuclear properties, 17-19
Ion-exchange water softeners, 7-58
Iridium, nuclear properties, 17-19
Iron, emissivity, 3-21
  nuclear properties, 17-18
  thermal conductivity, 3-14
Iron-constantan thermocouples (Tables), 18-07,
  18-08
Iron oxide, effect on feedwater, 7-51
  removal from feedwater, 7-51
  solubility in feedwater, 7-52
Irregular figures, geometry of, 20-58
Irregular solids, geometry of, 20-58
Isentropic change, gas, 5-02
  of state, equations, 1-11
Isentropic compression, 10-02
Isentropic expansion, 4-03, 10-02
Isentropic flow, pipes and vapers, 3-01
  vapers, 3-02
Isentropic horsepower, compressor, 1-38
Iso-octane, 14-75
Isopentane, data, 1-40
Isopropyl alcohol, 14-63
Isothermal change, gas, 5-02
Isothermal horsepower, compressor, 1-38
Isothermal standard, compressor, 1-38
Isotopes, 17-04
Jacobs engines, 13-53
Jet augmenter, 15-83
Jet compressors, 1-37, 1-49
Jet condensers, 9-02
  dimensions, 9-03
  maximum suction lift, 9-02
  permissible overloads, 9-02
  stability chart, 9-03
  water required, 9-07
Jet engines, propulsive efficiency, 15-19
Jet-propelled airplanes, performance, 15-64
Jet-propelled helicopters, 15-26
Jet propulsion, 15-37 (see also Gas turbines)
  combustion chamber, aerodynamic efficiency,
    15-57
  combustion efficiency, 15-57
  component efficiencies (Table), 15-57
  compressor efficiency, 15-57
  exhaust reheat in, 15-64
  factory production tests, 15-59
  flight tests, 15-59
  flying test bed, 15-59
  fuels for, 15-62
  injection of liquid in, 15-64
  installation, 15-61
  intake duct (ram) efficiency, 15-57
  liquids suitable for injection (Table), 15-64
  measurement of output, 15-58
  operation, 15-61
  performance data, 15-60
  propulsion nozzle, 15-56
  of rotating wings, 15-42
  tailpipe, 15-55
  tailpipe and propulsion nozzle efficiency, 15-57
  temperature control, 15-63
  test result corrections, 15-61
  test setup, 15-58
  testing, 15-58
  thermodynamics, 15-43
  thrust augmentation, 15-63
  turbine shaft and jet efficiency, 15-57
  useful power, 15-40
Jet propulsion power plants, application, 15-39
Jet propulsion systems, types, 15-40
Jet propulsion tests, corrections, 15-58
Jet-pump water systems, 5-79
Jet pumps, 5-79
  affinity relations, 5-81
  performance of centrifugal, 5-81
Joint, flanged, 6-09
  pipe, 6-09
Joint, insulated, 6-09
Joukowsky's equation, wave propagation, 5-17
Joule cycle, 15-43
Journal resistance, locomotive, 14-02
Kadanc system of supercharging, 13-11
Kaman Aircraft Corp., 15-25
Kaplan hydraulic turbine, 5-27, 5-29
<table>
<thead>
<tr>
<th>INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kellett Aircraft Corp., 15-25</td>
</tr>
<tr>
<td>Kelvin temperature scale, 18-02</td>
</tr>
<tr>
<td>Kerosene, 2-57, 2-58</td>
</tr>
<tr>
<td>heating value, 2-05</td>
</tr>
<tr>
<td>properties (Table), 2-59</td>
</tr>
<tr>
<td>thermal conductivity, 3-15</td>
</tr>
<tr>
<td>Kick's law for pulverizing coal, 7-33</td>
</tr>
<tr>
<td>Kilogram-calorie, 3-03</td>
</tr>
<tr>
<td>Kilojoule, 3-03</td>
</tr>
<tr>
<td>Kilojoule-calories, formulas (Table), 16-04</td>
</tr>
<tr>
<td>Kilojoule-watt, absolute, 3-51</td>
</tr>
<tr>
<td>Kilojoules, formulas (Table), 16-04</td>
</tr>
<tr>
<td>Kinematic viscosity, common fluids (Table), 5-03</td>
</tr>
<tr>
<td>Kinetic energy, 3-50</td>
</tr>
<tr>
<td>Kinsbury thrust bearings, 8-40</td>
</tr>
<tr>
<td>Kirchhoff's law, energy radiation, 3-21</td>
</tr>
<tr>
<td>Knock rating, aviation fuel, 13-50</td>
</tr>
<tr>
<td>gasoline, 14-74</td>
</tr>
<tr>
<td>Krypton, nuclear properties, 17-18</td>
</tr>
<tr>
<td>Kutter's coefficient, values, 5-15</td>
</tr>
<tr>
<td>Kutter's equation, 5-14</td>
</tr>
<tr>
<td>L.D.C. coal-burning gas turbine locomotives, 10-27</td>
</tr>
<tr>
<td>Labyrinth seals, turbine, 8-42</td>
</tr>
<tr>
<td>Lambda, turbine, 8-58</td>
</tr>
<tr>
<td>Laminar flow, 1-22</td>
</tr>
<tr>
<td>Laminar flow airfoils, 15-10</td>
</tr>
<tr>
<td>Landgraf Helicopter Co., 15-25</td>
</tr>
<tr>
<td>Lanova diesel engine, 13-17</td>
</tr>
<tr>
<td>Lanthanum, nuclear properties, 17-19</td>
</tr>
<tr>
<td>Latent heat, 3-07</td>
</tr>
<tr>
<td>butane, 2-60</td>
</tr>
<tr>
<td>ethanol, 2-59</td>
</tr>
<tr>
<td>of fusion (Table), 3-09</td>
</tr>
<tr>
<td>propane, 2-60</td>
</tr>
<tr>
<td>of vaporization (Table), 3-09</td>
</tr>
<tr>
<td>Laws, fan, 1-64</td>
</tr>
<tr>
<td>ventilation, 12-71</td>
</tr>
<tr>
<td>Lead, emissivity, 3-21</td>
</tr>
<tr>
<td>nuclear properties, 17-19</td>
</tr>
<tr>
<td>thermal conductivity, 3-14</td>
</tr>
<tr>
<td>Lead content, aviation fuel, 13-50</td>
</tr>
<tr>
<td>Leadwire compensation, 18-13</td>
</tr>
<tr>
<td>Leakage air, cooling of, refrigeration, 11-38</td>
</tr>
<tr>
<td>effect on condenser vacuum, 9-15</td>
</tr>
<tr>
<td>Leaking loss, turbine, 5-70</td>
</tr>
<tr>
<td>Length, measures of (Table), 20-45</td>
</tr>
<tr>
<td>metric equivalents (Table), 20-47</td>
</tr>
<tr>
<td>overall, of ships, 15-69</td>
</tr>
<tr>
<td>between perpendiculars, ships, 15-69</td>
</tr>
<tr>
<td>Lift, and drag, approximation, supersonic airfoil, 15-33</td>
</tr>
<tr>
<td>coefficients, 15-07</td>
</tr>
<tr>
<td>data, typical airfoils, 15-08</td>
</tr>
<tr>
<td>fundamental equations, 15-07</td>
</tr>
<tr>
<td>profile, 15-10</td>
</tr>
<tr>
<td>Lift-to-drag ratio, helicopters, 15-26</td>
</tr>
<tr>
<td>Light, velocity of, 17-03</td>
</tr>
<tr>
<td>Lighter-than-air craft, 15-26</td>
</tr>
<tr>
<td>Lightning arresters, 16-40</td>
</tr>
<tr>
<td>Lightning protection, 16-40</td>
</tr>
<tr>
<td>Lignite, combustion, 2-04</td>
</tr>
<tr>
<td>composition (Table), 2-30</td>
</tr>
<tr>
<td>Lima-Hamilton diesel engine, 13-19</td>
</tr>
<tr>
<td>Lime-soda treatment of water, 7-55</td>
</tr>
<tr>
<td>Linoleum, thermal conductivity, 3-14</td>
</tr>
<tr>
<td>Liquid capacitance, in process control, 18-28</td>
</tr>
<tr>
<td>Liquid fuels, 2-45 (see also name of fuel)</td>
</tr>
<tr>
<td>references, 2-61</td>
</tr>
<tr>
<td>Liquid-level control, 18-31</td>
</tr>
<tr>
<td>Liquid-level gages, 18-18</td>
</tr>
<tr>
<td>Liquid line, for water, 4-03</td>
</tr>
<tr>
<td>Liquid manometers, 18-15</td>
</tr>
<tr>
<td>Liquids, equation for flow, 18-20 (see also name of liquid)</td>
</tr>
<tr>
<td>expansion (Table), 3-11</td>
</tr>
<tr>
<td>free convection in, 3-18</td>
</tr>
<tr>
<td>saturated, 3-60</td>
</tr>
<tr>
<td>specific heat (Table), 3-05</td>
</tr>
<tr>
<td>thermal conductivity, 3-15</td>
</tr>
<tr>
<td>Liquefied petroleum gases, 2-60</td>
</tr>
<tr>
<td>Lithium, nuclear properties, 17-18</td>
</tr>
<tr>
<td>Ljungstrom air preheater, 7-35</td>
</tr>
<tr>
<td>Ljungstrom double-rotation turbine, 8-10</td>
</tr>
<tr>
<td>Ljungstrom regenerative air preheater, 7-40</td>
</tr>
<tr>
<td>Lloyd's boiler construction rules, 7-17</td>
</tr>
<tr>
<td>Load (def), 16-99</td>
</tr>
<tr>
<td>Load center system of power distribution, 16-22</td>
</tr>
<tr>
<td>Load coincidence (def), 16-99</td>
</tr>
<tr>
<td>Load curves, 16-08</td>
</tr>
<tr>
<td>chronological, 16-98</td>
</tr>
<tr>
<td>Load diversity (def), 16-99</td>
</tr>
<tr>
<td>Load-energy curve, 16-99</td>
</tr>
<tr>
<td>Load factor, 16-12; 16-99 (def)</td>
</tr>
<tr>
<td>Load limit, in aircraft, 15-23</td>
</tr>
<tr>
<td>Load release, turbine, 8-49</td>
</tr>
<tr>
<td>Loading, power, airplanes, 15-18</td>
</tr>
<tr>
<td>wing, airplanes, 15-17</td>
</tr>
<tr>
<td>Locked-train gear, 15-77</td>
</tr>
<tr>
<td>Lockheed feedwater-heater header, 7-47</td>
</tr>
<tr>
<td>Lockheed Aircraft Corp., 15-04</td>
</tr>
<tr>
<td>Locomotive (see Locomotives)</td>
</tr>
<tr>
<td>Locomotive boilers, 14-18</td>
</tr>
<tr>
<td>ASME code, 7-18</td>
</tr>
<tr>
<td>combustion chamber (Table), 14-07</td>
</tr>
<tr>
<td>effect of fire-tube length, 14-06</td>
</tr>
<tr>
<td>Locomotive characteristics, 14-04</td>
</tr>
<tr>
<td>Locomotive chart, 4-8-4 type, 14-08</td>
</tr>
<tr>
<td>Locomotive classification, electric, 14-47</td>
</tr>
<tr>
<td>Locomotive cut-offs, 14-08</td>
</tr>
<tr>
<td>Locomotive details, 14-11</td>
</tr>
<tr>
<td>Locomotive diesel engines, 14-43</td>
</tr>
<tr>
<td>Locomotive driving wheels, balancing, 14-23</td>
</tr>
<tr>
<td>Locomotive dynamic augment, 14-22</td>
</tr>
<tr>
<td>Locomotive feedwater heaters, heat saving (Table), 14-21</td>
</tr>
<tr>
<td>Locomotive frames, 14-16</td>
</tr>
<tr>
<td>Locomotive gas turbine, efficiency, 10-26</td>
</tr>
<tr>
<td>fuel consumption, 10-26</td>
</tr>
<tr>
<td>a-c, load performance, 10-18</td>
</tr>
<tr>
<td>Locomotive power plants, comparative efficiency (Table), 10-26</td>
</tr>
<tr>
<td>gas turbine, 10-25</td>
</tr>
<tr>
<td>Locomotive reciprocating parts, inertia forces of, 14-32</td>
</tr>
<tr>
<td>Locomotive stokers, 14-18</td>
</tr>
<tr>
<td>Locomotive superheaters, 14-19</td>
</tr>
<tr>
<td>Locomotive tenders, 14-20</td>
</tr>
<tr>
<td>resistance (Table), 14-03</td>
</tr>
<tr>
<td>Locomotives, a-c, 14-46</td>
</tr>
<tr>
<td>a-c, performance curves, 14-50</td>
</tr>
<tr>
<td>a-c, articulated, 14-04</td>
</tr>
<tr>
<td>auxiliary generator voltages, 14-39</td>
</tr>
<tr>
<td>auxiliary generators, 14-39</td>
</tr>
<tr>
<td>boiler capacity, 14-06</td>
</tr>
<tr>
<td>boiler evaporation, 14-06</td>
</tr>
<tr>
<td>brakes, 14-58</td>
</tr>
<tr>
<td>Brown Boveri, 10-25</td>
</tr>
<tr>
<td>cab shapes, 14-56</td>
</tr>
<tr>
<td>coal consumption as a function of superheat, 14-19</td>
</tr>
<tr>
<td>counterbalancing of wheels, 14-22</td>
</tr>
<tr>
<td>crown sheet protection, 14-18</td>
</tr>
<tr>
<td>curve resistance, 14-04</td>
</tr>
<tr>
<td>d-c, 14-46</td>
</tr>
<tr>
<td>diesel, 14-29</td>
</tr>
</tbody>
</table>
Logarithms (continued)  
hyperbolic functions (Table), 20-24  
mantissa of, 20-02  
multiplication by, 20-03  
Napierian, of numbers (Table), 20-22  
natural, of numbers (Table), 20-22  
raising numbers to powers, 20-03  
rules for use, 20-02  
Loop of action, automatic control, 18-23  
Loss of head in conduits, 5-12 (see also Pressure drop)  
Losses, in buckets, 8-19  
at conduit entrances, 5-12  
diesel engine thermodynamic, 13-08  
generator, 8-69  
pump, 5-63  
reaction turbine blading, 8-22  
turbine exhaust, 8-23, 8-66  
turbine hood, 8-23  
turbine leaving, 8-23  
turbine mechanical, 8-66, 8-69  
Low-head boiler, 7-07  
Low-voltage switchgear, 16-62  
LP gases, uses, 2-60  
Lubricating oil economy, diesel engine, 13-28  
Lubricating-oil systems, diesel, 13-22  
engine, 14-68  
Lubricating oils, diesel, characteristics, 13-34  
turbine, 8-46  
Lubrication, steam engine, 8-111  
turbine, 8-44  
Luscombe Airplane Corp., 15-05  
Lycoming engines, 13-53  
Lysholm compressors, 10-40, 10-41  
Mach number, 1-102 (def), 3-63 (def); 5-04, 15-07, 15-28  
change in, with friction, 3-67  
determination of, 3-66  
behind oblique shock, 15-32  
Mach number correction, airfoil characteristics, 15-11  
Mach reflection, 15-34  
Mach waves, 15-28  
Machinery, space occupied by ship, 15-69  
Machines, cold-air refrigeration, 11-28  
Maclaurin's series, 20-75  
Magnesium, nuclear properties, 17-18  
thermal conductivity, 3-14  
Magnesium compounds, effect on feedwater, 7-51  
removal from feedwater, 7-51  
solubility in feedwater, 7-52  
Magnetizing current, 16-41  
Main rods, locomotive, 14-11  
Maintenance, diesel engine, 13-35  
power plant, 16-12  
Make-up evaporators, 3-81  
Make-up water, evaporation of, 7-57  
Mallet articulated locomotives, 14-04  
Manoeuvring of ships, 15-71  
Manganese, nuclear properties, 17-18  
Manganin, thermal conductivity, 3-14  
Manifolding, automotive engine, 14-78  
Manning's equation, 5-15  
Manometer liquids, 18-16  
Manometer ring, 18-15  
Manometers, inclined-tube, 18-15, 18-16  
indicating-recording, 18-17  
liquid, 18-15  
ring-type, 18-16  
U-tube, 18-15  
Manometric coefficient, pump, 5-52  
Mantissa, of logarithms, 20-02  
Manufacturer, gas burners, 7-72
INDEX

Manufacturers (continued)
hydraulic turbines, 5-48
oil burners, 7-74
stokers, 7-71
water-cooled walls, 7-81
Marine design considerations, 15-69
Marine diesel engines, 15-81
Marine engineering, 15-69
Marine fuel oil characteristics (Table), 15-72
Marine gas turbines, 10-29
Marine Inspection Service, 15-72
Marine steam plants, 15-78
Marine transportation, 15-01
references, 15-83
Martin, Glenn L., Co., 15-04
Martin's formula for leakage through labyrinth, 8-42
Masonry linings, water flow through, 5-15
Masonry materials, thermal conductivity, 12-04, 12-08
Mass, metric equivalents (Table), 20-47
Mass density, common fluids (Table), 5-03 (see also name of fluid)
dimensions, 5-05
Mass and energy, equivalence of, 17-03
Matching of gas turbines and compressors, 10-37
Material balance, combustion, 2-07
Materials, aircraft, 15-03
aircraft engine, 13-42
aircraft structural, weights (Table), 15-05
building thermal properties (Table), 12-04
fertile, thorium, 17-10
fissionable, plutonium, 17-10
uranium, 17-10
fissile and fertile, 17-10
pipe, 8-02
allowable stress in (Table), 8-08
expansion of (Table), 8-07
fittings for, 8-04
to resist cavitation, 5-38
structural, for nuclear reactors, 17-11
superheater, 7-29
surface condenser, 9-12
turbine casing, 8-50
turbine diak, 8-27
valve, 6-04
Mathematical formulas, references, 20-85
Mathematical tables, 20-01
Maximum demand (def), 18-99
Maxwell relations, 3-55
McDonnell Aircraft Corp., 15-25
Mean calorie, 3-02
Mean effective pressure, automotive engine, 14-76
brake, 13-44
diesel cycle, 13-06
how to find, 8-102
refrigeration, 11-07
of typical internal-combustion engines (Tables), 15-17, 15-18, 15-19
Mean indicated pressure, steam engine commercial (Table), 8-103
Mean temperature difference, 3-31
easy method, 11-44
Measurement, flow, 1-13
flow, by head measurement, 18-19
flowing water, 5-19
fluid flow, 19-19
head, 18-18
heat, 3-02
pressure, 18-15
process variables, 13-02
references, 18-22
temperature, 18-02
Measures, weights, and units, 20-44
Meat, storage, 11-40
Meat markets, refrigeration requirements, 11-43
Meat-storage rooms (Table), 11-42
Mechanical-atomizing oil burners, 7-74
Mechanical-draft cooling tower, sizing chart, 9-25
Mechanical-drive turbines, performance, 8-60
Mechanical efficiency, 15-05
automotive engine, 14-90
gasoline engine (def), 13-45
steam engine (Table), 8-110
Mechanical equivalent of heat, 3-03
Mechanical losses, centrifugal pump, 5-65
turbine, 8-66, 8-69
Mechanical refrigeration, 11-03
Mechanics, fluid, 5-02
Melting points, alloys (Table), 3-07
chemical elements (Table), 3-06
inorganic compounds (Table), 3-07
organic compounds (Table), 3-08
Meniscus corrections for mercury (Table), 19-08
Mensuration, 20-55
Mercury, nuclear properties, 17-19
thermal conductivity, 3-14
Mercury arc rectifiers, 16-78
Mercury cycle efficiency, 8-95
Mercury power equipment, standardization of, 8-95
Mercury-steam power plants, 8-95
Mercury-steam stations, operating conditions (Table), 8-98
Mercury turbine, 16-12
Mercury vapor, properties (Table), 4-07
Mercury-vapor-steam cycle, 4-06
Meta cresol purple, 7-53
Metal-clad switchgear (Table), 16-64
Metal temperature in air preheaters, 7-37
Metallic rectifiers, 18-83
Metallic surfaces, emissivity, 3-21
Metalurgy, high-temperature, 10-32
Metals, for high temperature, 8-29, 10-35
thermal conductivity, 3-13
Meteorological conditions in North America (Table), 9-24
Meters, current for flowing water, 5-20
quantity, 18-19
velocity, 18-19
venturi, 5-21
Methane, Beattie-Bridgeman constants, 3-57
combustion, 2-04
critical-state properties, 3-60
data, 1-40
gas constants, 3-54
specific heat at zero pressure, 3-58
thermal conductivity, 3-16
viscosity, 1-15
Methanol, freezing point of water solution, 14-83
Methyl alcohol, combustion, 2-04
Methyl chloride, 11-10, 11-19 (Table)
critical-state properties, 3-60
data, 1-40
p-h chart, 11-18
thermal conductivity, 3-16
Methyl formate, 11-18
Methyl red, 7-53
Metric measures, units, 20-46
Metric system, 20-46
Metropolitan-Vickers Electrical Co. Ltd., turbojet, 15-67
Mica, thermal conductivity, 3-14
Micron (def), 7-91
Millivoltmeter, 18-12
accuracy of, 18-12
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mills, pulverising, classification and drying of coal in,</td>
<td>7-23</td>
</tr>
<tr>
<td>Mills system, steam heating,</td>
<td>12-26</td>
</tr>
<tr>
<td>Mineral acids, effect on feedwater,</td>
<td>7-51</td>
</tr>
<tr>
<td>removal from feedwater,</td>
<td>7-51</td>
</tr>
<tr>
<td>Mining locomotives, diesel,</td>
<td>14-40</td>
</tr>
<tr>
<td>Missiles, guided, 15-02</td>
<td></td>
</tr>
<tr>
<td>Mitchell's method, stress in piping,</td>
<td>6-16</td>
</tr>
<tr>
<td>Mixed-flow compressors, ASME test code, 19-02</td>
<td></td>
</tr>
<tr>
<td>Mixed flow impeller, 10-30, 10-40</td>
<td></td>
</tr>
<tr>
<td>Mixed stage, turbine, 10-31</td>
<td></td>
</tr>
<tr>
<td>Mixture ratio, aircraft engine, 13-46</td>
<td></td>
</tr>
<tr>
<td>automotive engine, 14-78</td>
<td></td>
</tr>
<tr>
<td>effects in Otto and diesel cycles, 13-06</td>
<td></td>
</tr>
<tr>
<td>Mixtures, density of, 2-03</td>
<td></td>
</tr>
<tr>
<td>gas constant of, 3-54</td>
<td></td>
</tr>
<tr>
<td>liquid and vapor, 3-60</td>
<td></td>
</tr>
<tr>
<td>of perfect gases, 3-54</td>
<td></td>
</tr>
<tr>
<td>Moderator, in nuclear reactions, 17-10</td>
<td></td>
</tr>
<tr>
<td>Modulus, of elasticity, common fluids (Table), 5-03</td>
<td></td>
</tr>
<tr>
<td>of elasticity, dimensions, 5-05</td>
<td></td>
</tr>
<tr>
<td>pipe materials, temperature correction, 6-16</td>
<td></td>
</tr>
<tr>
<td>free convection, 3-17</td>
<td></td>
</tr>
<tr>
<td>Moisture in steam, 7-19</td>
<td></td>
</tr>
<tr>
<td>equation for, 7-22</td>
<td></td>
</tr>
<tr>
<td>Moisture content, exhaust steam, 8-25</td>
<td></td>
</tr>
<tr>
<td>Molar heat capacity of gases (Table), 2-10</td>
<td></td>
</tr>
<tr>
<td>Molar specific heats, 2-98 (see also Specific heat)</td>
<td></td>
</tr>
<tr>
<td>Mollier diagram, 4-07</td>
<td></td>
</tr>
<tr>
<td>Molybdenum, nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-14</td>
<td></td>
</tr>
<tr>
<td>18-8 molybdenum, composition, 10-35</td>
<td></td>
</tr>
<tr>
<td>Moment coefficient, airfoils, 15-09</td>
<td></td>
</tr>
<tr>
<td>Momentum, 2-70</td>
<td></td>
</tr>
<tr>
<td>Monel metal, emisivity, 3-21</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-14</td>
<td></td>
</tr>
<tr>
<td>Monochlorodifluoromethane, 11-16(Chart), 11-17 (Table)</td>
<td></td>
</tr>
<tr>
<td>Monocoupe Aircraft &amp; Engine Corp., 15-05</td>
<td></td>
</tr>
<tr>
<td>Monolithic wall linings for furnaces, 7-76</td>
<td></td>
</tr>
<tr>
<td>Monoplanes, 15-02</td>
<td></td>
</tr>
<tr>
<td>Mooring winches, 15-82</td>
<td></td>
</tr>
<tr>
<td>Motor circuits, circuit-breakers for (Table), 16-60</td>
<td></td>
</tr>
<tr>
<td>Motor-generator sets, 16-83</td>
<td></td>
</tr>
<tr>
<td>induction, characteristics (Table), 16-77</td>
<td></td>
</tr>
<tr>
<td>synchronous, characteristics (Table), 16-77</td>
<td></td>
</tr>
<tr>
<td>Motor oils, automobile engine, 14-68</td>
<td></td>
</tr>
<tr>
<td>Motor starters, high-voltage, 16-29</td>
<td></td>
</tr>
<tr>
<td>high-voltage fused, 16-29</td>
<td></td>
</tr>
<tr>
<td>short-circuit current (Table), 16-29</td>
<td></td>
</tr>
<tr>
<td>Motor starting, effect on generator voltage, 16-18</td>
<td></td>
</tr>
<tr>
<td>Motors, diaphragm, 18-25</td>
<td></td>
</tr>
<tr>
<td>Multiple-effect evaporation, 3-75</td>
<td></td>
</tr>
<tr>
<td>Multiple-effect evaporators, calculations, 3-77</td>
<td></td>
</tr>
<tr>
<td>Multiple-retort stokers, 7-65, 7-68</td>
<td></td>
</tr>
<tr>
<td>boiler capacity range, 7-65</td>
<td></td>
</tr>
<tr>
<td>Multistage compression, 1-41</td>
<td></td>
</tr>
<tr>
<td>Multistage impulse turbine, 8-03 (see also Turbines)</td>
<td></td>
</tr>
<tr>
<td>Murphy diesel engine, 13-18</td>
<td></td>
</tr>
<tr>
<td>N-155 alloy, composition, 10-35</td>
<td></td>
</tr>
<tr>
<td>Naphthalene, combustion, 2-04</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>Napier &amp; Son Ltd., propjet, 15-08</td>
<td></td>
</tr>
<tr>
<td>Napierian logarithms, 20-02</td>
<td></td>
</tr>
<tr>
<td>of numbers (Table), 20-22</td>
<td></td>
</tr>
<tr>
<td>National Superior diesel engine, 13-19</td>
<td></td>
</tr>
<tr>
<td>Natural convection, 3-39</td>
<td></td>
</tr>
<tr>
<td>Natural frequency, condenser tube, 9-14</td>
<td></td>
</tr>
<tr>
<td>Natural gas, 2-04 (Table); 2-94</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>Natural logarithms of numbers (Table), 20-22</td>
<td></td>
</tr>
<tr>
<td>Navy boiler construction specifications, 7-17</td>
<td></td>
</tr>
<tr>
<td>Neon, critical-state properties, 3-60</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>Neptunium, nuclear properties, 17-19</td>
<td></td>
</tr>
<tr>
<td>Nested-type gear, 15-75</td>
<td></td>
</tr>
<tr>
<td>Neutral grounding, 16-39</td>
<td></td>
</tr>
<tr>
<td>Neutrons, delayed, approximate half-lives, 17-07</td>
<td></td>
</tr>
<tr>
<td>delayed, percentages, 17-07</td>
<td></td>
</tr>
<tr>
<td>lifetime, 17-13</td>
<td></td>
</tr>
<tr>
<td>thermal, 17-08</td>
<td></td>
</tr>
<tr>
<td>Newspaper, heating value, 2-44</td>
<td></td>
</tr>
<tr>
<td>HEs, data (Table), 5-03 (see also Ammonia)</td>
<td></td>
</tr>
<tr>
<td>Nickel, thermal conductivity, 3-14</td>
<td></td>
</tr>
<tr>
<td>Nickel, emisivity, 3-21</td>
<td></td>
</tr>
<tr>
<td>nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-14</td>
<td></td>
</tr>
<tr>
<td>Niobium, nuclear properties, 17-19</td>
<td></td>
</tr>
<tr>
<td>Nipples, pipe, length of (Table), 6-33</td>
<td></td>
</tr>
<tr>
<td>Nitric oxide, critical-state properties, 3-60</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>Nitrogen, Beattie-Brudzeman constants, 3-57</td>
<td></td>
</tr>
<tr>
<td>critical-state properties, 3-60</td>
<td></td>
</tr>
<tr>
<td>data, 1-40</td>
<td></td>
</tr>
<tr>
<td>gas constants, 3-54</td>
<td></td>
</tr>
<tr>
<td>molar heat capacity, 2-10</td>
<td></td>
</tr>
<tr>
<td>nuclear properties, 17-18</td>
<td></td>
</tr>
<tr>
<td>specific heat at zero pressure, 3-58</td>
<td></td>
</tr>
<tr>
<td>thermal conductivity, 3-16</td>
<td></td>
</tr>
<tr>
<td>viscosity, 1-15</td>
<td></td>
</tr>
<tr>
<td>Nitrous oxide, data, 1-40</td>
<td></td>
</tr>
<tr>
<td>No-load steam consumption, condensing turbines (Table), 8-84</td>
<td></td>
</tr>
<tr>
<td>Nodular graphite, in pipe, 6-15</td>
<td></td>
</tr>
<tr>
<td>Noise, aircraft engine, 13-51, 13-55</td>
<td></td>
</tr>
<tr>
<td>fan, 1-72</td>
<td></td>
</tr>
<tr>
<td>Noncondensing turbines, 8-12, 10-11</td>
<td></td>
</tr>
<tr>
<td>efficiency (Table), 8-81</td>
<td></td>
</tr>
<tr>
<td>Nonextraction heat rates, 8-73, 8-78</td>
<td></td>
</tr>
<tr>
<td>theoretical (Table), 8-73</td>
<td></td>
</tr>
<tr>
<td>theoretical percentage reduction in (Table), 8-73</td>
<td></td>
</tr>
<tr>
<td>Nonferrous convectors, heat output, 12-15</td>
<td></td>
</tr>
<tr>
<td>Nonmiscible materials for water softening, 7-60</td>
<td></td>
</tr>
<tr>
<td>Normal shock waves, 15-29</td>
<td></td>
</tr>
<tr>
<td>flow relations (Table), 15-30</td>
<td></td>
</tr>
<tr>
<td>Northrop Aircraft Inc., 15-04</td>
<td></td>
</tr>
<tr>
<td>Noising, of locomotives, 14-22</td>
<td></td>
</tr>
<tr>
<td>Nozzle and bucket efficiency, 8-36</td>
<td></td>
</tr>
<tr>
<td>Nozzle coefficients, convergent-divergent, 8-17</td>
<td></td>
</tr>
<tr>
<td>flow measurement, 1-19, 1-20</td>
<td></td>
</tr>
<tr>
<td>Nozzle discharge, theoretical (Table), 8-10</td>
<td></td>
</tr>
<tr>
<td>Nozzle efficiency, 8-14, 8-17</td>
<td></td>
</tr>
<tr>
<td>formula, 8-16</td>
<td></td>
</tr>
<tr>
<td>Nozzle-end loss, turbine, 8-38</td>
<td></td>
</tr>
<tr>
<td>Nozzle velocity, theoretical, 8-15</td>
<td></td>
</tr>
<tr>
<td>Nozzles, 8-15</td>
<td></td>
</tr>
<tr>
<td>area, 8-18</td>
<td></td>
</tr>
<tr>
<td>converging-diverging, shock in, 8-17</td>
<td></td>
</tr>
<tr>
<td>cross section of, 8-18</td>
<td></td>
</tr>
<tr>
<td>flow of steam in, 8-17</td>
<td></td>
</tr>
<tr>
<td>flow formulas, 1-10</td>
<td></td>
</tr>
<tr>
<td>flow measurement by, 1-13</td>
<td></td>
</tr>
<tr>
<td>overexpansion and underexpansion in, 8-18</td>
<td></td>
</tr>
<tr>
<td>rammed, 8-15</td>
<td></td>
</tr>
<tr>
<td>subacoustic, 3-68</td>
<td></td>
</tr>
<tr>
<td>superacoustic, 3-69</td>
<td></td>
</tr>
<tr>
<td>thermodynamic relations, 3-68</td>
<td></td>
</tr>
<tr>
<td>velocity coefficient, 8-16</td>
<td></td>
</tr>
<tr>
<td>Nuclear physics, references, 17-20</td>
<td></td>
</tr>
<tr>
<td>units, 17-03</td>
<td></td>
</tr>
<tr>
<td>Nuclear processes, 17-02</td>
<td></td>
</tr>
<tr>
<td>Nuclear reactivity, 17-11</td>
<td></td>
</tr>
<tr>
<td>Nuclear structure, 17-04</td>
<td></td>
</tr>
</tbody>
</table>
INDEX

Null-bridge resistance thermometer, 18-13
Number, atomic, 17-04
Froude's, 5-04, 15-07
Mach, 5-04, 15-07, 15-28
mass, 17-04
Nusselt, 3-17
Reynolds', 5-04, 15-07
Numbers, properties of, 20-26
Nuts, material standards for, 6-05

Oats, heating value, 2-44
Oblique shock wave, Mach number behind, 15-32
flow relations, 15-31
Octane, combustion, 2-04
critical-state properties, 3-60
Octane number (def), 14-75
Odor removal from air, 12-73
Oil, castor, thermal conductivity, 3-15 (see also Oils)
density (Table), 5-03
effect on feedwater, 7-51
fuel, preheating temperatures (Table), 2-57
requirements (Table), 2-46
specifications, 2-46
storage and handling, 2-54
heat release (Tables), 2-54, 7-75
kinematic viscosity (Table), 5-03
lubricating, SAE grades, 13-35
thermal conductivity, 3-15
mass density (Table), 5-03
methods of burning, 2-50
modulus of elasticity (Table), 5-03
removal from feedwater, 7-51
shale, 2-60
steam engine, separation from exhaust steam, 8-112
surface tension (Table), 5-03
viscosity (Table), 5-03

Oil auxiliary heaters, 2-57
Oil burners, 7-72
boiler capacity range, 7-05
manufacturers, 7-74
mechanical draft, 2-50
pressure atomizing, effect of pressure and viscosity by spray angle (Table), 2-50
rotary, 7-74
steam-atomizing, external mixing, 7-72
premixing in, 7-72
types, 2-50

Oil burning, references, 2-61
Oil coolers, diesel, 13-22
turbine, 8-45
Oil-diesel engine, 13-02
Oil filter, automotive, 14-68
Oil fuels, residues, 2-49
Oil gas, 2-64
Oil piping, turbine, 8-45
Oil purification, diesel, 13-22
Oil recommendations for turbines (Table), 8-47
Oil required per bearing, 8-44

Oiling systems, turbine, 8-44

Oils, color index values (Table), 2-48 (see also Oil)
classification of lubricating (Table), 14-68
detergent, 14-69
diesel fuel, 13-32
diesel lubricating, 13-34
filtration and purification, 8-46
free convection in, 3-18
heating value, 2-44
oxidation, 8-46
specific gravity, 2-47

Old English wire gage, 16-08
Open conduits, flow in, 5-12

Open cycle gas turbine (def), 10-11 (see also Gas turbines)

Open-delta transformer connections, 16-71
Open feedwater heaters, 7-43
Operating costs, of diesel per kilowatthour, 13-26
power plant, 16-11
Operation, chain-grate stoker, 7-66, 13-35
gas producer, 2-90
gas turbine, 10-45
jet propulsion, 15-61
Operation factor (def), 16-99
Opposed-piston engine (def), 13-03

Optical pyrometers, 18-14
accuracy, 18-15
temperature of (Table), 18-15

Ordinances on fly-ash emission, 7-94

Organic acids, effect on feedwater, 7-51
removal from feedwater, 7-51
Organic compounds (see also name of compound)
boiling points (Table), 3-08
melting points (Table), 3-08

Organic matter, effect on feedwater, 7-51
removal from feedwater, 7-51

Orifice flow coefficient (Tables), 18-20, 18-21 (see also Orifice)

Orifice plates, flow coefficients for, 1-16, 1-17

Orifices, coefficient of discharge (Table), 5-10
discharge of air through (Table), 1-18
flow, 5-09
flow formulas, 1-10
flow measurement by, 1-13
installation data, 1-17
rectangular, 5-11
with sharp edges, coefficients for (Table), 5-11
square-edge, 1-18
flow coefficients for, 1-17

Ornithopter, 15-02

Osmium, nuclear properties, 17-19

Ostwald calorie, 3-02

Ostwald chart, flue-gas analysis, 2-06

Otto cycle, 13-07
compression ratio effects, 13-06
mixture ratio effects, 13-06
Otto cycle engines, 15-44

Output factor (def), 16-99

Oven coke, 2-38

Overcurrent, directional, 16-36
ground, 16-37
instantaneous, 16-35
inverse-time, 16-33

Overcurrent protection, 16-27, 16-30

Overcurrent trip characteristics, 16-32
Overcurrent unit, directional, 16-32

Overdeck superheater, 7-25

Overexpansion in nozzles, losses, 8-18

Overfeed stokers, 7-65 (see also Stokers)
coal, 2-34
combustion rates, 7-65
combustion volume, 7-66

Overfire jets, in boiler furnaces, 7-71

Overload capacity, of electrical equipment, 16-33

Overload factors, steam engine (Table), 81-05

Over-speed governor, turbine, 8-49

Oxidation of oils, 8-46

Oxygen, Beattie-Bridgeman constants for, 3-57
critical-state properties, 3-60
data, 1-40
dissolved, in feedwater, 7-54
effect on feedwater, 7-51
in feedwater, test for, 7-54
gas constants, 3-54
molar heat capacity, 2-10
INDEX

Oxygen (continued)
nuclear properties, 17-18
removal from feedwater, 7-51
solubility in feedwater, 7-52
specific heat at zero pressure, 3-58
thermal conductivity, 3-16
viscosity, 1-15

Palladium, nuclear properties, 17-18
Panel heating, 12-13, 12-57
advantages and disadvantages, 12-58
design coefficients, 12-60
floor vs. wall vs. ceiling, 12-58
generalised design procedure, 12-58
references, 12-60
required water temperature and spacing, 12-59

Panel heating systems, design, 12-57
Paper, thermal conductivity, 3-14
Parabola, geometry of, 20-57
Paraboloid of revolution, geometry of, 20-61
Parallel operation, diesel engines, 13-18
synchronous generators, 16-20
transformers, 16-71
Parallelepiped, rectangular, geometry of, 20-59
Parallelogram, geometry of, 20-55
Parasite resistance, aircraft, 15-14
Parasitic losses, gas turbine, 10-12
Parazo orange, 7-53
Parsons coefficient, turbine, 8-58
Part-load performance, locomotive gas turbine, 10-18

Partial pressure, gage, 3-51
saturated air (Table), 9-06

Particles, alpha, 17-05
electron, 17-02
meson, 17-02
neutrino, 17-02
neutron, 17-02
and photons, interaction with matter, 17-05
positron, 17-02
properties of fundamental, 17-03
proton, 17-02

Passenger cars, railroad, resistance (Table), 14-03
tractive resistance, 14-48
Peak load (def), 16-59

Peat, 2-42
Pennsylvania Railroad turbine locomotive, 14-24
Penstock length, inertia due to, 5-45
Penstocks, pressure changes in, 5-46
Pentane, data, 1-40
Perfect gases, 3-53 (see also name of gas)
gas constants (Table), 3-54
processes (Table), 3-56

Performance, aircraft engine, 13-44
at altitude, 13-48
effect of compression ratio, 13-47
effect of mixture ratio, 13-46
effect of spark advance, 13-46
effect of speed, 13-46
airship, 16-27
atmospheric cooling tower, 9-25
boiler, 7-12
coefficient of refrigeration, 3-52, 11-06
compressor, 1-46
helicopter, 15-26
jet propelled airplane, 15-64
rotary vacuum pump, 1-48
steam turbine, 8-57
Performance analysis, airplane, 15-16
Performance calculations, turbojet, 15-53
Performance characteristics, engine, 13-44
gas turbine, 10-11
Performance curves, diesel engine, 13-30, 13-31
Performance data, jet propulsion, 15-60

Performance factors, automotive vehicle, 14-61
Performance ratios, gas turbine, 10-16
Performance variation of refrigeration systems, 11-27
Peripheral pumps, 5-78
Perishable products, storage (Table), 11-40
Personal aircraft (Table), 15-05
Pencara system, 10-06
Petroleum, chemical composition, 2-49
Petroleum coke, 2-30
heating value, 2-44
Petroleum industries, references, 2-61
p-h chart, refrigeration, 11-04 (see also name of refrigerant)
PH range of indicator solutions (Table), 7-53
pH value, by color indicators (Table), 7-53
explanation, 7-52
feedwater, 7-50, 7-54
zeolite water softeners, 7-59
Phase conversion, electrical, 18-84
Phase transformation, connections for, 16-71
Phenol, data, 1-40
Phenol red, 7-53
Phosphorus, nuclear properties, 17-18
Photoelectric pyrometers, 18-15
Phthalein red, 7-53
Physical properties, common fluids, 5-02; 5-03
(Table) (see also name of substance)
pipe materials, 6-02
refrigerants, 5-10
steels for tubing (Table), 6-29
Physical quantities, dimensions (Table), 5-05
Physics, health, 17-17
Pi theorem, Buckingham's, 5-05
Pizecki Helicopter Corp., 15-25
Piezometer, 5-11
Pipe, 6-02
allowable stress (Table), 6-08
brass (Table), 6-32
cast-iron, 6-02
copper (Table), 6-32
dimensional standards, 6-04
double extra strong, dimensions (Table), 6-26
equalization of (Table), 1-32, 12-36
Everdur (Table), 6-32
ferrous, properties (Table), 6-03
flow of air in, 6-44
flow of fluids in, 6-35
gaskets, 6-09
graphitization, 6-15
heat losses (Table), 3-43
large pressure drop in (graphical method), 6-45
minimum wall thickness (formula), 6-07
nonferrous, properties (Table), 6-03
pressure loss in, 6-35
seamless steel, dimensions (Table), 6-25
weights (Table), 6-26
steel, 6-02
stress calculations (Table), 6-21
wall thickness of, 6-07
water hammer allowance, 6-09
welded, dimensions (Table), 6-26
steel, 6-24
weights, 6-26
wrought-iron, 6-27
welding of, 6-13
wrought-iron, dimensions (Table), 6-27
weights (Table), 6-28

Pipe expansion, formula, 6-07
Pipe fittings, 6-04
flow resistance, 6-36
materials, 6-04
pressure drop, 1-34
Pipe flanges, pressure-temperature ratings (Table), 6-10
Pipe friction, 3-04
Pipe insulation, heat losses through, 3-46
Pipe joints, 6-00
Pipe lines, stresses, 6-15
Pipe materials, 6-02
  allowable stress (Table), 6-08
  effect of temperature (Table), 6-08
  expansion (Table), 6-07
  properties, 6-02
  roughness (Table), 6-37
  temperature limits (Table), 6-15
Pipe nipples, length (Table), 6-53
Pipe roughness, 5-06
Pipe sizes (Table), 6-25
  low-pressure steam-heating, 12-32
  refrigeration, 11-25
Pipe stress, calculation form (Table), 6-21
Pipe threads, data, 6-33; 6-34; 6-35 (Tables)
Piper Aircraft Corp., 15-05
Piping, 6-01
  ASA code for pressure, 6-02
  code for pressure, 6-06
  diesel engine, 13-21
  expansion of, 6-07
  heat losses, 12-20
  for high pressures and temperatures, 6-15
  maximum temperature for pressure, 6-06
  oil, turbine, 8-45
  partial end constraints for, 6-23
  pressure drop, 6-45
  remedies for high stress, 6-24
  steam heating, pressure losses, 12-29
  steam turbine, 8-53
  welding procedure, 6-14
Piping codes, 6-02
Piping materials, specifications and properties
  (Table), 6-03
Piping stresses, method of multiple anchors, 6-19
Piping systems, hot-water heating, 12-37
Piping tax, 12-20
Piston acceleration, 14-70
Piston and connecting-rod position, 14-69
Piston displacement, reciprocating compressor, 1-43
  refrigeration compressor, 11-07
Piston rings, aircraft engine, 13-43
Piston speed, 13-05
  of typical internal-combustion engines (Tables), 13-17, 13-18, 13-19
Piston travel (Table), 14-70
Piston velocity, 14-69
Pistons, aircraft engine, 13-43
  engine, 13-43
  forces on, 14-72
  and rings, automotive engine, 14-66
  side thrust of, 14-72
Pitch, heating value, 3-44
Pitch coke, analysis, 2-38
Pitching and rolling of ships, 15-69
Pitot tube, 5-21
  use of, for upstream pressure, 1-12
Planch’s constant, 17-02
Plane rectilinear figures (Table), 20-55
Plant factor (def), 16-99
Plant layout, instrumentation, 18-83
Plants, nuclear reprocessing, 17-17
Plaster, conductivity, 11-37
Plastering materials, thermal conductivity, 12-05
Plate-and-fin regenerator, 10-44
Platinoid, thermal conductivity, 3-14
Platinum, emissivity, 3-21
Platinum (continued)
  nuclear properties, 17-19
  thermal conductivity, 3-14
Platinum-Pt 10% Rh thermocouple, emf (Table), 18-11
Platinum-Pt 13% Rh thermocouple, emf (Table), 18-10
Platinum-rhodium thermocouples, 18-07
Plutonium, 17-10
  nuclear properties, 17-19
Pneumatic controllers, 18-25
Pneumatic tools, 1-56
Pole (def), 6-41
Polyhedrons, regular, geometry of, 20-59
Polygon, general, geometry of, 20-56
  regular, geometry of, 20-56
  spherical, geometry of, 20-61
Polarity of transformers, 16-67
Polytropic change, gas, 5-02
Polytropic process, 3-51
Poppet valve gear, locomotive, 14-20
Potassium, nuclear properties, 17-18
  thermal conductivity, 3-14
Potentiometer, thermocouple, 18-12
Pound calorie, 3-02
Pore point, fuel oil, 2-46
Power (def), 16-09 (see also Horsepower)
  atomic, 17-02
  to compress gas, 1-46
  conversion of nuclear, 17-15
  cost of producing, 16-94
  cost of purchased, 16-09
  effect of altitude on compressor, 1-47
  electric, 16-03
  fuel consumption, in U. S. (Table), 16-87
  generated, 16-11
  growth, in U. S., 16-84
  means for converting, 16-76
  metric equivalents (Table), 20-49
  primary, 16-09
  purchased vs. generated, 16-09
  rate schedule, 16-09
  secondary, 16-09
  for ships, 15-69
  when to generate, 18-11
Power bill, example of monthly, 16-10
Power coefficient, aircraft propeller, 15-20
Power conversion, a-c to d-c, 16-83
  a-c to d-c, 16-76
  d-c to a-c, 16-83
Power correction factors, automotive engine (Table), 14-96
Power development in U. S., 16-84
Power distribution, 16-22
  circuit arrangements, 16-23
  load center system, 16-22
  primary system, 16-24
  radial system, 16-23
  secondary network system, 16-23
  secondary selective system, 16-23
  secondary systems, 16-24
  voltage selection, 16-25
Power factor, calculations, 16-44
  of a group of loads, 16-43
  of induction motors, 16-46
  lagging, 16-42
  leading, 16-42
Power-factor improvement, 16-41, 16-42; 16-45 (Table)
  electrical losses reduced, 16-44
  release of capacity by, 16-44
  rate clauses, 16-44
  by synchronous motors, 16-48
  voltage level raised by, 16-44
INDEX

Power generation, capacity in U. S. (Table), 16-85
  gas turbine, 10-02
  by states (Table), 16-86
  by type of prime mover (Table), 16-87
Power loading, airplane, 15-18
  helicopter, 15-26
Power-plant cycle efficiency, jet propulsion, 15-39
Power-plant cycles, references, 4-29
Power plants, aircraft, 15-18
  atomic, 17-02
  investment in, 16-89
  maintenance, 16-12
  mercury, 8-95
  mobile atomic, 17-17
  operating costs, 16-11
Power production, geographical distribution, 16-38
Power pumps, speeds (Table), 5-73
Power sources, 16-09
Power supply, economics of, 16-84
  electric locomotive, 14-46
Power systems, atomic, 17-16
Power test codes, 19-01
  list of, 19-02
Power transformers, ratings (Tables), 16-52, 16-69
Power transmission, alternating current, 16-04
  direct current, 16-04
  electric, 16-04
  power factor, 10-04
  power losses, 16-04
  voltage drop, 16-04
Prandl number, 3-17
Praseodymium, nuclear properties, 17-19
Pratt & Whitney Aircraft, turbojet, 15-66
Pratt & Whitney engines, 13-53
Precipitators, electrical, 7-69
Precombustion chamber, diesel, 13-04
Precooler, gas turbine (def), 10-09
Preferred standard turbines, ASME-AIEE (Table), 8-12
Preheaters, air, 7-30, 7-34 (see also Air preheaters) oil, 2-56
  in oil refineries, 7-40
Preignition, engine, 13-47
Pressure (def), 19-10
  absolute, 18-15
  brake mean effective, 13-05, 13-44
  conversion, for barometers and U tubes, 19-09
  of units, 15-16
  critical, 8-15
  dimensions, 5-05
  gage, 18-15
  locomotive bearing, 14-11
  mean effective, automotive engine, 14-76
  refrigerating compressor, 11-07
  mean indicated, 13-05
  methods of measuring, 18-15
  metric equivalents (Table), 20-49
  relative, in air tables, 1-02
  standard sea-level, 15-06
  steam engine mean effective, 8-102
  units, 18-15
  and velocity relations, in fan practice, 1-79
Pressure capacitance, in control, 18-28
Pressure carburetor, 13-49
Pressure changes, in penstocks, 5-46
Pressure control, 18-30
Pressure curves, turbine stage, 8-68
Pressure distribution, airfoil spanwise, 15-09
Pressure drop, air flowing through ducts, 12-50
  air in pipes (Table), 1-25
Pressure drop (continued)
  air preheater, 7-38
  closed feedwater heater, 7-47
  economiser, 7-34
  effect of temperature on, 12-51
  in elbows, equivalent length of pipe, 6-40
  large (graphical method), 6-45
  gases, 6-41
  in pipes, 1-23, 6-44
  in pipe fittings, 1-34
  in rectangular ducts, 12-51
  regenerator, 10-44
  reheater, 8-91
  in round ducts, 12-51
  steam-heating main, 12-31; 12-32 (Table)
  steam-heating piping, 12-29
  superheater, 7-29
  in tubing, pipe, and fittings, 6-35
  turbulent flow, 6-36
  valve, 6-36
  vapor-liquid mixtures, 6-36
  viscous flow, 6-36
Pressure firing of boilers, 10-08
Pressure loss (see Pressure drop)
Pressure measurement, ASME rules, 19-06
Pressure piping, code, 6-06
Pressure range for piping, 6-06
Pressure ratio, critical, 8-15
  gases (Table), 3-02
  gas turbine, 10-11
Pressure-regulating governors, turbine, 8-48
Pressure regulators, 18-24
Pressure rise, axial-flow compressor, 1-99
Pressure taps, static, 1-14
Pressure-temperature ratings, flanges (Tables),
  6-10, 6-11, 6-12, 6-13
Pressure vessels, unfired, construction code, 7-17
Price, of distribution transformers (Table), 16-69
  (see also Cost)
  standard power transformers (Table), 16-68
Primary substation, 16-49
Primary systems, power distribution, 16-24
Prime power (def), 16-100
Priming, boiler, 7-20, 7-43
  drain cooler, 7-49
Prism, general, geometry of, 20-59
  general truncated, geometry of, 20-59
  rectangular, geometry of, 20-59
  truncated triangular, geometry of, 20-59
Prismatoid, geometry of, 20-59
Process characteristics, effect on control, 18-28
Process dynamics, 18-35
Process gas compression, 10-09
Process heat from gas turbines, 10-22
Process instrumentation, 18-32
Process load changes, 18-36
Process steam from evaporators, 3-80
Processes, batch, 19-32
  continuous, 18-32
  thermal, control of, 18-28
Producer gas, 2-64, 2-77
  from coke, combustion table, 2-72
Producers, gas, 2-87
  references, 2-93
Profile drag, 15-10
Profile lift, 15-10
Program control, of processes, 18-38
Propagation of flame, 2-69
Propane, 11-10
  combustion, 2-04
  critical-state properties, 3-60
  data, 1-40
  properties (Table), 2-60
Propeller fans, 1-56, 1-93
INDEX

Propeller fans (continued)
capacity table and dimensions, 1-90
mechanical efficiency, 1-93

Propeller shaft, automotive vehicle, 14-83

Propellers, aircraft, reduction gears for, 13-44
selection chart, 15-21
airplane, 15-20
characteristics of ship (Table), 15-75
coefficients for aircraft, 15-20
diameter of aircraft, empirical formula, 15-20
materials for ship, 15-73
ratings of aircraft (Table), 15-22
ship, 15-73
blade sections, 15-73
blade thickness fraction, 15-73
developed area ratio, 15-73
diameter, 15-73
mean width ratio, 15-73
projected area ratio, 15-73
shifting and bearings, 15-74
thrust bearings, 15-75
thrust of, 15-17
weight of aircraft (Table), 15-22

Propelling machinery, ship, 15-71

Properties, ammonia (Table), 11-11 (see also name of substance)
of aqua-ammonia solutions, 11-31
combustion gas, 2-93
of numbers, 20-26
physical, various refrigerants (Table), 11-10
pipe material, 6-02
refrigerant, 11-10 (Table); 11-11
salt brine, 11-51
superheated ammonia (Table), 11-14
chart, 11-12
thermal, of substances, 3-02

Propjets, 15-19, 15-40
American (Table), 15-68
control of, 15-63
English (Table), 15-68
General Electric, 15-42

Proportional action, automatic controllers, 18-24

Propulsion nozzle, jet propulsion unit, 15-56

Provisional area, turbujet, 15-53

Propulsive efficiency, jet, 15-59
jet engine, 15-19

Propylene, combustion, 2-04
data, 1-40

Protection, overcurrent, 16-27, 16-30

Protective relaying switchgear, 16-65

Protective system, selectivity of electrical, 16-31

Psf function, Gibbs', 3-55

Psychrometric chart, 1-07, 1-08, 12-76

temperature, 11-59

Pulse jet, 15-19

Pulserometer, 5-83

Pulverization, fineness of, effect on combustion, 7-89

Pulverized coal (def), 7-82 (see also Coals)
bin storage of, 7-85
boiler capacity range, 7-05
burners for, 2-36
range of, 7-89
combustion, 7-87
combustion rate, 7-04
direct-fired system, 7-86
energy for preparing, 7-82, 7-83
explosion hazards, 7-90
feeders for, 7-82
fineness, 7-82
fire hazards, 7-90
firing, 2-35
furnace volume, 7-75
heat-release rates, 7-75

Pulverized coal (continued)
horizontal-type burner for, 7-88
loss due to unburned fuel, 7-89
preparation cost, 7-82
range of fuel-burning equipment, 7-87
references, 2-44
requirements of fuel-burning equipment, 7-87
roll feeders, 7-82
sizing of, 7-82
stability of fuel-burning equipment, 7-87
storage systems, 7-86
surface area, 7-82
table feeders for, 7-82
tangential burner for, 7-88
type of firing, 7-88
vertical burner for, 7-88

Pulverized-coal classifier, centrifugal-type, 7-85

Pulverizers, ball, 7-85
ball-race, 7-85
cement, 7-82
evaluation of, 7-86
function of, 7-82
impact, 7-85
ring-roll, 7-85

Pulverizing, coal preparation, 7-82

Pump characteristics, 5-50

Pump efficiency, 5-50

Pump valves, 5-74

Pumping engines, 5-71

Pumping limit, axial-flow compressor, 10-39

Pumping viscous liquids, 5-68

Pumps, 5-48, 5-49

affinity laws, 5-50
air-lift, 5-82
ASME test code, 19-03
axial-flow, 5-60
boiler-feed, 7-42
reciprocating, 7-43

capacity coefficient, 5-53
capacity constants, 5-54
centrifugal, 5-48
capacity regulation, 5-70
cavitation, 5-66
disk friction loss, 5-84
efficiency definitions, 5-52
hydraulic losses, 5-61
impeller layout, 5-56
mechanical losses, 5-65
reverse rotation, 5-67
volumetric efficiency, 5-52
volute casing, 5-58
crossover, 5-59
dependable, 5-59
design constants, 5-54
duplex, 5-72
gear, 5-77
geometrically similar, 5-51
head coefficient, 5-53
heat, 12-61
impeller design, 5-53
impulse turbo, 5-78
inverted turbo, 5-76
jet, 5-79
losses, 5-63
mean effective diameter, 5-54
motor-driven power, 5-72
net positive suction head of, 5-51
performance curves, 5-61
reciprocating, 5-71
steam-driven displacement, ASME test code, 19-03
references, 5-83
rotary, 5-76
rotary plunger, 5-78
INDEX

Pumps (continued)
screw, 5-78
simpex, 5-72
specific speed of, 5-51
speed constants, 5-54
theoretical characteristics, 5-52
thrust of, 5-65
triplex, 5-72
variable-stroke, 5-76
velocity diagrams, 5-53
vertical turbine, 5-59
Purchased power, 16-09
Purification of oils, 8-46
pv diagram for diesel cycle, 13-02
Pyramid, general, geometry of, 20-59
right regular, geometry of, 20-59
Pyrometers, optical, 18-14
photoelectric, 18-15
radiation, 18-13
temperature range (Table), 18-13
thermocouple, 18-07
true temperature of optical (Table), 18-15
Quadrilateral, general, geometry of, 20-56
Quadrilateral inscribed in circle, geometry of, 20-56
Quantity meters, 18-19
Quartz, thermal conductivity, 3-14
Quick freezing, 11-52
Radial aircraft engines, 13-42
Radial-flow turbine, 8-10
Radial stress, disks, 8-28
Radians, in degrees and minutes (Table), 20-53
Radiant baseboard, heating by, 12-13
Radiant energy, interchange of, 3-21
Radiant superheaters, 7-24
Radiation, 3-12
black-body, 3-22
* carbon dioxide, 3-24
combined, from two constituents, 3-25
gas, beam lengths, 3-25
gas and flame, 3-23
nuclear, 17-02
principles of energy, 3-20
solar (Table), 3-25
sky, 3-26
water vapor, 3-24
Radiation conductance, 3-39
Radiation and convection, combined, 3-30
Radiation load, 12-16
Radiation pyrometers, 18-13
accuracy, 18-14
Radiation screens, 3-41
Radiation temperature factor, curves, 3-23
Radiator, heating, 12-12 (see also Radiators)
Radiator branch and rizer sizes (Table), 12-38
Radiator valve capacities (Table), 12-33
Radiator valves, rating (Table), 12-29
Radiators, anti-freeze for, 14-03
cast-iron, dimensions and ratings (Table), 12-14
correction factors (Table), 12-15
heat emission, 12-16
pressure caps for automotive, 14-63
rating of heating, 12-14
Radioactive series, 17-05
Radioactivity, 17-04
references, 17-20
Radium, nuclear properties, 17-19
Radius, hydraulic, 5-09
Radius taps (flow measurement), 1-16
Rags, heating value, 2-44
Railcars, diesel (Table), 14-41
diesel-powered, 14-40
Ram jet, 15-19, 15-42
Range, airplane, 15-18
airship, 15-27
thermocouple, 18-07
Ranger engines, 13-54
Rank, classification of coal by, 2-18
Rankine cycle efficiency, 4-04
Rankine temperature (def), 3-52
Rankine temperature scale, 18-02
Rate action, automatic controller, 18-24
control system, 18-30
Rate schedule, example, 16-10
power, 16-09
Rateau stage, turbine, 10-31
Rating tests, fan, 1-70
Ratings, fan, 1-81
radiator valve (Table), 12-29
refrigerating machine, 11-02
Ratio, aspect, 15-06, 15-11
structural material weight, aircraft (Table), 15-05
Ratio control of two variables, 18-38
Raymond Bowl Mill, pulverized-coal, 7-85
Reactance diagram, 16-30
Reactance and resistance, relation between, 16-05
Reaction, in steam turbine stages, 8-21
vortex design, 15-55
Reaction blading, 8-22
losses, 8-22
Reaction curves, typical process, 18-29
Reaction hydraulic turbine, 5-26, 5-27, 5-28
runners for, 5-31, 5-32
Reaction stage, gas turbine, 10-31
Reactions, chain, 17-07
gamma-ray, 17-06
neutron, 17-06
Reactors, control of nuclear, 17-15
design, 17-14
fast, 17-14
gaseous fuel, 17-13
heterogeneous, 17-14
homogeneous, 17-14
intermediate, 17-14
liquid fuel, 17-13
nuclear, 17-09
primary, 17-17
secondary, 17-17
solid fuel, 17-13
thermal, 17-14
types, 17-13
Real gases, 3-37 (see also name of gas)
Receivers, compressor, 1-54
flow of air from, 1-18
Reciprocals of numbers, 20-27
Reciprocating boiler-feed pumps, 7-43
Reciprocating compressors, data (Table), 11-22
indicator cards, 1-43
references, 1-57
in refrigeration, 11-20
Reciprocating pumps, 5-71
suction lift of, 5-73
Recirculation-type boiler, 7-09
Recorders, 18-38
Rectangle, geometry of, 20-55
Rectangular ducts, flow of air in, 1-32
Rectangular orifices, 5-11
Rectifiers, 16-78
hot-cathode, 16-82
ignition, characteristics (Table), 16-78
mercury-arc, 16-78
metallic, 16-83
Recuilinear figures, plane (Table), 20-55
Receivers, 7-40
metallic, 7-40
Recuperators (continued)
  refractory, 7-40
Reducing balance depreciation, 16-92
Reduction gears, propeller, 15-44
  ship, 15-75
  characteristics (Table), 15-76
Re-expansion loss, compressor, 1-41
Reference junction compensation, thermocouples, 18-09, 18-12
References, air transportation, 15-88
  atomic energy, 17-20
  automatic control, 18-32
  axial-flow fans, 1-57
  blowers, 1-57
  boilers, 7-30
  chemistry of combustion, 2-12
  chemistry of feedwater, 7-63
  coal and coke, 2-44
  combustion, 2-12
  compressed air, 1-57
  compressors, 1-57
  diesel-electric locomotives, 14-45
  electric locomotives, 14-80
  elliptic functions, 20-85
Evaporators, 3-82
  fans, 1-57
  flow of fluids, 6-47
  furnaces, 7-82
  gas combustion, 2-86, 2-87
  gas turbines, 10-47
  heat pump, 12-70
  heat transfer, 3-34
  heating, 12-57
  hydraulic turbines, 5-49
  hydraulics, 5-23
  inflammability of gases, 2-86, 2-87
  instrumentation, 18-22
  insulation, 3-34, 3-49
  liquid fuels, 2-61
  marine transportation, 15-83
  mathematical formulas, 20-85
  measurement of process variables, 18-22
  nuclear physics, 17-20
  oil burning, 2-61
  panel heating, 12-60
  petroleum industry, 2-61
  power plant cycles, 4-29
  power test codes, 19-02
  producers, 2-93
  pulverised coal, 2-44
  pumps, 3-83
  radioactivity, 17-20
  reciprocating compressors, 1-57
  refrigeration, 11-48
  reboiler heating, 4-39
  solid fuels, 2-44
  steam, 4-29
  steam engines, 8-112
  surface thermal conductance, 3-49
  thermodynamics, 3-68
  turbines, 8-98
  Refractory gas, data, 1-40
  Refractor, neutron, 17-11
  Refractory 25, composition, 10-35
  Refractories, thermal conductivity (Table), 3-37
  Refractory, desired properties, 7-78
  Refractory walls, air-cooled, 7-77
  solid, 7-75
  Refrigerant flow rate, 11-05
  Refrigerant properties, 11-11 (see also name of refrigerant)
  Refrigerants, physical properties (Table), 11-10
  properties (Table), 11, 11-10
  toxic properties (Table), 11-19
  Refrigerating goods, space required (Table), 11-43
  Refrigerating effect, useful, 11-05
  Refrigerating machines, rating, 11-02
  Refrigerating system, diagram of, 11-03
  Refrigerating systems, ASME test code, 19-03
  performance variation, 11-27
  vacuum, 11-28
  Refrigeration, 11-02
  absorption, 11-29
  accessory equipment in, 11-45
  Allen dense-air machine, 11-28
  capacity control of compressors, 11-11
  carbon dioxide, 11-15 (Table); 11-17
  centrifugal compressors in, 11-22
  cold-air machines, 11-29
  tests (Table), 11-28
  compressor horsepower, 11-05
  cycle calculation, 11-04
  dense-air machines, 11-28
  expansion valves, 11-03, 11-47
  heat removed in condenser, 11-05
  heat sources in a space, 11-40
  heat transmission, 11-36
  ideal cycle, 11-04
  large boxes (Table), 11-43
  mechanical, 11-03
  multistage compression, 11-09
  p-h chart, 11-04
  references, 11-48
  ship, 15-83
  steam consumption (Table), 11-35
  steam-jet vacuum, 11-03
  test code, 11-02
  ton of, 11-02
  vapor compression, 11-03
  work of compression in, 11-05
  Refrigeration compressors, 11-20
  clearance, 11-08
  volumetric efficiency, 11-08
  Refrigeration cycle, 11-03
  Refrigeration load, 11-36
  Refrigeration methods, artificial, 11-02
  Refrigeration requirements, various purposes (Table), 11-43
  Refrigeration surface, coefficients of heat transfer (Table), 11-44
  Refrigeration systems, ammonia-absorption, 11-31
  binary vapor, 11-11
  Regeneration, effect in steam cycles, 8-72
  Regenerative braking, locomotive, 14-57
  Regenerative cycle, estimating data, 8-77
  Regenerative pumps, 5-78
  Regenerative–reheat turbine, 8-12
  Regenerative steam cycle, 4-05
  Regenerative turbine, 8-10
  Regenerator effectiveness, gas turbine, 10-11
  gas turbine, effect of flow arrangement, 10-44
  Regenerator pressure drop, gas turbine, 10-44
  Regenerators, 7-40
  effectiveness, 10-53
  gas turbine, 10-43
  definition, 10-09
  economics, 10-43
  plate-and-fin type, 10-44
  vacuum, 11-25
  types of surface, 10-44
  refractory, 7-40
  Regulators, warm-air, carrying capacity (Table), 12-41
  warm-air, delivery rating, 12-42
  Regulation, of generators in parallel, 16-22
  governors on turboalternators, 8-48
  hydraulic turbine, 5-43
  self- 18-39
INDEX

Regulation (continued)
- voltage, generators, 18-17
- Regulators, pressure, 15-24
- Regulatory bodies for ships, 15-72
- Reheat, gain from, 8-91
- Reheat cycle for steam, 4-05
- Reheat factor (Table), 8-71
- Reheat turbines, 8-91
- Reheaters, 7-19, 7-30
- gas turbine (def.), 10-09
- pressure drop in steam, 8-91
- Relative efficiency, engine (def.), 13-45
- Relative humidity, 1-07, 12-74
- in North America (Table), 9-24
- Relaxation stress, 10-34
- Reliability of diesel locomotives, 14-45
- Relief heating system, one-pipe, 12-25
- Relief valves, atmospheric, 9-15
- atmospheric, sizes (Table), 9-16
- Reset action, automatic controllers, 18-24
- control systems, 18-30
- Resinous cation exchanger, in water treatment, 7-60
- Resistance, air, automotive vehicles, 14-62 (see also Drug and Pressure drop)
- air, cables, 15-15
- flat plates, 15-15
- hemispheres, 15-14
- spheres, 15-14
- streamlined bodies, 15-14
- struts, 15-15
- wires, 15-15
- of automotive vehicles, 14-62
- controlled processes, 18-28
- copper wire and cable (Table), 18-07
- elbows, tees, valves, and pipe bends, 6-36
- flange, of wheels, 14-02
- fluid, 15-06
- freight car (Table), 14-03
- locomotive, mechanical, 14-03
- locomotive tender (Table), 14-03
- parasite, in aircraft, 15-14
- in terms of flat plate, 15-16
- process, units, 18-28
- railroad passenger car (Table), 14-03
- rolling, automotive vehicles, 14-62
- on straight level track, 14-02
- thermal, 12-03, 18-28
- train, 14-02
- valve and fitting (Table), 12-31
- Resistance formulas, electric locomotive (Table), 14-48
- Resistance and reactance, relation between, 16-05
- Resistance-thermometer bulbs, characteristics (Table), 18-12
- Resistance thermometers, 18-12
- accuracy, 18-13
- deflection, 18-13
- Resistivity, copper, 16-07
- temperature coefficient, 16-07
- Resistor, field discharge, 16-17
- Resonance escape probability, in nuclear physics, 17-11
- Restaurant, refrigeration requirements of, 11-43
- Resuperheating, 7-30
- references, 4-29
- Return air ducts, carrying capacity (Table), 12-43
- sizes (Table), 12-44
- Reversibility, 3-64
- definition, 3-52
- Reversible frictionless flow, 3-65
- Reversible-pitch propellers, braking with (Table), 15-21
- Reversible process, 3-53
- Reynolds' number, 1-102, 5-04, 15-07
- scale effects, 15-11
- Rheostat, generator field, 16-17
- Rhodium, nuclear properties, 17-18
- thermal conductivity, 3-14
- Rhodium-platinum thermocouples, 18-07
- Rhomboid, geometry of, 20-55
- Rigid airships, characteristics (Table), 15-27
- Ring-roll mill, pulverized-coal, 7-85
- Rittinger's law for pulverizing coal, 7-83
- Road locomotive, diesel, 14-33, 14-38
- Road tests, automotive vehicle, 14-86
- Rock core, conductivity, 11-07
- Rock drills, performance (Table), 1-58
- Rock salt, thermal conductivity, 3-14
- Rockets, 15-19, 15-40
- Rods, locomotive main and side, 14-11
- Roe, A. V., Canada Ltd., turbojet, 15-67
- Roentgen equivalent physical, 17-20
- Rolls-Royce Ltd., turbojet, 15-67
- Roofing, thermal conductivity, 12-05, 12-06
- Roofs, heat gain (Table), 12-79
- Room air changes (Table), 12-11
- Roots blower (cross section), 1-36
- Roots-Connersville compressor, 1-49
- Rotameter, 18-22
- Rotary augmenter, 15-83
- Rotary compressors, 1-49
- Rotary oil burners, 7-74
- Rotary plunger pumps, 5-78
- Rotary pumps, 5-76
- Rotary-stem valves, 18-27
- Rotary vacuum pump, performance, 1-48
- Rotating elements, critical speed, 1-108
- Rotating wings, jet propulsion of, 15-42
- Rotation loss, turbine disk, 8-37
- centrifugal pumps, 5-64
- Rotors, critical speed, 8-40
- steel for turbine, 8-39
- stresses in turbine, 8-38
- turbine, 8-27
- Roughness, pipe, 5-06
- pipe material (Table), 6-37
- Roughness factor, 15-07
- Roughness ratio, 1-24, 6-35
- Rubber, thermal conductivity, 3-14
- Rubbing speed factor, locomotive bearings, 14-11
- Rubidium, nuclear properties, 17-18
- Run-of-river station (def.), 16-100
- Runner proportions, hydraulic turbine, 5-32
- Runners, reaction hydraulic turbine, 5-32
- Ruthenium, nuclear properties, 17-19
- Ryan Aeronautical Co., 15-05

S-686 alloy, composition, 10-35
S-890 alloy, composition, 10-35
S-816 alloy, 15-52
composition, 10-35
SAE grades of lubricating oils, 13-35
SAE viscosity classification (Table), 14-48
Safety factor, boiler, 7-17
pressure vessel, 7-17
Salt brine, properties (Table), 11-51
Salt-solution method, flow of water, 5-23
Salt velocity method, flow of water, 5-22
Salts, increase in boiling temperature due to (Table), 3-08
Salvage value, 16-91
Samarium, nuclear properties, 17-19
Sampling, of coal, 2-21
of steam, 7-20
Sand, thermal conductivity, 3-14
Saturated air, 12-74
Saturated liquid, 3-60
Saturated steam, pressure table, 4-36
  temperature table, 4-34
Saturated vapor, 3-60
Saturation line for steam, 4-03
Sawdust, heating value, 2-44
  thermal conductivity, 3-14
Saybolt Universal viscometer, 6-42
Saybolt Universal viscosity, 6-42
SFI ratings, commercial boilers (Table), 12-19
  data, residential boilers (Table), 12-18
Scale, conductivity of boiler, 7-14
Scale formation, cause of, 7-54
Scattering, alpha, 17-05
  beta-ray, 17-05
  elastic, 17-06
  inelastic, 17-06
Scavenging air, 13-03
Schedule numbers for pipe (Table), 6-25
Screen sizes, 2-20
  standard (Table), 7-85
Screens, compressor air intake, 1-53
Screw pumps, 5-75
Sea-level pressure, standard, 15-06
Sea-level rating, diesel engine, 13-14
Sea speed, ships, 15-69
Sea welds, pipe, 6-14
Seals, turbine labyrinth, 8-42
Seamless steel pipe, dimensions (Table), 6-25
  weights (Table), 6-26
Seamless tubing, properties of steel used (Table),
  6-29
  weight per foot (Table), 6-31
Secondary heating surface, economic, 3-33
Secondary substations, 16-53
Secondary systems, in power distribution, 16-24
Section characteristics, airfoil, 15-11
Sectional-header boiler, 7-08
Sector, spherical, geometry of, 20-60
Sedimentation in feedwater treatment, 7-55
Segments (Table), 20-50
  of a circle, areas (Table), 20-52
Seibel helicopter, 15-25
Selenium, nuclear properties, 17-18
Self-actuation, brake, 14-81
Self-propelled trains, 14-40
Self-regulation, controlled processes, 18-28
Sellers Injector (Table), 7-41
Semi-anthracite coal, composition (Table), 2-26
Semicircle, geometry of, 20-57
Semiclosed cycle, gas turbine (def), 10-11
Separating calorimeter, 7-22
Series, radioactive, 17-05
Series expansions of functions (Table), 20-75
Service life of property, 16-01
Settings, height of, stoker-equipped boilers
  (Table), 7-86
Shaft diameters, first approximation, 8-38
Shale oil, 2-60
Shape factor, in fluid flow, 5-08
Sheathing, thermal conductance of, 12-09
Sheet gage, 16-08
Shell pressure curves, turbine, 8-63
Shell-and-tube ammonia condensers (Table),
  11-46
Sheppard diesel engine, 13-17, 13-18
Shield, biological, 17-15
Ships, alternating-current propulsion of, 15-78
  auxiliaries, 15-81
  boilers, 15-80
  characteristic of U. S. (Table), 15-69
  condensers, 15-80
  direct-current propulsion, 15-78
  distilling plants, 15-83
  electric-drive, 15-78
  geared-turbine units for, 15-79
  refrigeration of, 15-83
  service machinery, 15-82
  single-screw, 15-71
  speed and power characteristics (Table), 15-70
  twin-screw, 15-71
Shock, 8-17, 15-28
  applications, 15-33
  bow, 15-32
  data, 15-28
  detached, 15-32
  detachment of, 15-35
Shock patterns, three-dimensional, 15-35
  two-dimensional, 15-30
Shock theory, 3-70
Shock waves, 1-102, 15-29
  conical, flow relations, 15-36
  flow relations through, 15-36
  forked, 15-35
  normal, 15-29
  flow relations (Table), 15-30
  oblique, flow relations, 15-31
Shocks, compression, 3-70
Short-circuit currents, 16-27
  asymmetrical, 16-27
  calculation, 16-27
  sources, 16-27
Short circuits, three-phase, 16-30
Short tubes, flow through, 5-09
Shrink fits for disks, 8-35
Shrouds, bucket, 8-24
Shutdown of gas turbines, 10-46
Side rods, locomotive, 14-11
Sieve, U. S. standard, 7-85
  W. S. Tyler, 7-85
Sigma, cavitation constant, 5-67
Signal-system investment, 16-90
Signaling, controls for, 15-38
Sikorsky Aircraft Div., 15-25
Silica, boiler scaling properties, 7-54
  effect on feedwater, 7-51
  removal from feedwater, 7-51
  solubility in feedwater, 7-52
Silica gel, 11-35
Silicon, nuclear properties, 17-18
Sil-O-Cel, thermal conductivity, 3-38
Silver, emissivity, 3-21
  nuclear properties, 17-18
  thermal conductivity, 3-14
Similarity, dynamic, 5-04
Simple impulse turbine, 8-02
Simplex pump, 5-72
Single phase circuits, 16-04
Sinking-fund depreciation, 16-92
Sinking pumps, air required, 1-57
Size, copper bar (Table), 16-06
  screen, standard (Table), 7-85
Size and capacity, commercial expansion tanks
  (Table), 12-39
Size and weights, copper wire and cable (Table),
  16-06
Sizing, of pulverized coal, 7-82
Skating rinks (ice), refrigeration requirements,
  11-43
Skidding coefficient of friction, automobile, 14-81
Skin friction conduit losses, 5-14
Sky radiation, 3-20
Sky and solar radiation, heat gain (Table), 12-78
Slab insulations, thermal conductivity, 12-07
Slag-tap furnaces, 7-81
Slagging furnaces, 7-81
Slags, viscosity of, 2-23
Slate, thermal conductivity, 3-14
INDEX

Sleeve-valve aircraft engine, 13-44
Sliding angles, 9-32
Sip-stem valves, 18-27
Sip-stream effect, airplane, 15-16
Sip-stream velocity, 15-17
Slots, wing, 15-12; 15-13 (Table)
Sluice gates, discharge through, 5-11
Smoke (def), 7-91
Smoke elimination, 7-94
Smoke ordinances, reference, 7-97
Snow, thermal conductivity, 3-14
Sodium, thermal conductivity, 3-14
Sodium aluminate, feedwater treatment by, 7-58
Sodium carbonate, feedwater treatment by, 7-57
Sodium chloride solutions, boiling points (Table), 3-74
specific heat (Table), 3-06
Sodium compounds, effect on feedwater, 7-51
removal from feedwater, 7-51
solubility in feedwater, 7-52
Sodium-cycle cation exchangers, 7-60
Sodium-cycle exchangers for water treatment, 7-58
Sodium phosphate, common forms of, 7-57
feedwater treatment by, 7-57
Softeners, ion-exchange water, 7-58
Soft, average temperature, 12-43
Thermal conductivity, 3-14 (Table); 12-66
Solar radiation (Table), 3-25
Solar and sky radiation, heat gain from (Table), 12-78
Solenoid valves, 18-26
Solid fuels, 2-17
references, 2-44
Solid of revolution, geometry of, 20-62
Solids, dissolved, in feedwater, 7-54
expansion of (Table), 3-10
in feedwater, test, 7-54
nonmetallic, thermal conductivity, 3-13
specific heat of (Table), 3-06
Solubility of impurities in feedwater (Table), 7-52
Solutions of ammonia-water, 11-30
Sonic velocity, 15-28
Soot blowers for economizers, 7-33
Source, plane, of neutrons, 17-09
point, of neutrons, 17-08
Source and sink distribution, 5-09
Space requirements, boiler, 7-06
refrigerated goods (Table), 11-43
turbine, 8-94
Span of thermometers, 18-06
Spark plugs, aircraft engine, 13-49
Specific fuel consumption, engine (def), 13-45
Specific gravity, aviation fuel, 13-50 (see also name of substance)
butane, 2-60
dry gas, 2-75
ethanol, 2-59
gas, wet basis, 2-75
gasoline, 2-59
kerosene, 2-59
oils, 2-47
propane, 2-60
wood, 2-40
Specific heat, 3-03
air, high pressures, 3-59
variation with temperature, 3-59
butane, 2-60
chemical elements (Table), 3-04
at constant pressure, air, 1-03
at constant volume, air, 1-03
determination, 3-03
effect of pressure, 1-06
fuel oils, 2-48
Specific heat (continued)
gases (Tables), 3-05, 3-54, 3-58
gasoline, 2-59
kerosene, 2-59
liquids (Table), 3-05
mixtures, 3-54
molar, 2-98
of gases, 2-10
propane, 2-60
sodium chloride solutions, 3-06
solids (Table), 3-06
substances, 3-03
vapors (Table), 3-05
Specific heat ratio, air, 1-03
gases (Tables), 3-05, 3-54
vapors (Table), 3-05
Specific humidity, 1-07
Specific output of typical internal-combustion engines (Tables), 13-17, 13-18, 13-19
Specific speed, hydraulic turbine runner, 5-24
pump, 5-51
selection of, for pumps, 5-53
Specific volume, ammonia solutions (Table), 11-34
gasoline, 2-59
kerosene, 2-59
saturated air (Table), 9-06
Specific weight, typical internal-combustion engines (Tables), 13-17, 13-18, 13-19
Specifications, aviation fuel, 13-50
coal, 2-24
diesel fuel oil, 13-32
flange material, 6-04
fuel oil, 2-46
valve material, 6-04
Speed, boiler-feed pump, 7-42 (see also Speeds)
internal combustion engine (Tables), 13-17, 13-18, 13-19
locomotive diameter, 14-11
maximum, of airplanes, 15-17
propagation of flame, 2-69
stalling, airplane, 15-17
Speed/length ratio, ships, 15-71
Speed measurements, 19-04
Speed ranges, airplane power plants, 15-19
Speed ratings, 60-cycle generator, 16-16
Speed regulation, hydraulic turbine, 5-43
Speed-tractive effort characteristics, locomotive, 14-30
Speeds, belted exciter (Table), 16-17 (see also Speed)
critical, 8-36
generator synchronous, 5-27
power pump (Table), 5-73
turbine, 5-12
Spheres, drag of, 15-14
geometry of, 20-60
Spheroids, geometry of, 20-61
Spillways, submerged, 5-18
Spinning reserve (def), 16-100
Splash surface, cooling tower, 9-28
Spontaneous combustion, 2-33
Spray cooler, 9-22
Spray ponds, 9-29
average final temperatures (Table), 9-29
nozzle pressures, 9-30
Spreader stokers, 7-70
air requirements, 7-71
boiler capacity range, 7-05
cinder losses, 7-71
coals used, 7-71
combustion rates, 7-04, 7-71
with continuous-ash-discharge grates, 7-70
dumping grates, 7-70
INDEX

Spreader stokers (continued)
fly ash from, 7-93
furnace design, 7-71
heat-release rates, 7-75
manufacturers, 7-71
with stationary grates, 7-70
Spring, deflection of semi-elliptic, 14-80
Square, geometry of, 20-55
Square roots of numbers, 20-27
Squares of numbers, 20-27
Stability, aircraft, 15-22
axialplane, 15-22
directional, 15-23
lateral, 15-23
compressor (def), 10-39
of control, 18-30
longitudinal, 15-22
Stability limit, axial-flow compressor, 10-39
Stage, impulse, 8-02
turbine, 8-08
Stalling speed, airplane, 15-17
Standard atmosphere (Table), 15-06
Standard specific weight, atmospheric air, 15-06
Standards, diesel engine, 13-14
diesel governor, 13-16
fan, 1-58
fitting dimensional, 6-05
flange dimensional, 6-05
valve dimensional, 6-05
Star-delta transformer connections, 16-71
Star-star transformer connections, 16-70
Starting, of gas turbine power plant, 15-50
of gas turbines, 10-45
Starting characteristics, automotive engine, 14-74
State, characteristic equation of, 3-53
equation of, 5-02
properties of, partial derivatives, 3-55
State-line, turbine, 8-63, 8-08
Static balance, 8-39
Static pressure holes, 19-10
Stationary grates, boiler capacity range, 7-05
combustion rate, 7-04
Steady-blade material, 15-32
Steady-flow process, 3-51
Steam, condition of exhaust, 4-08
enthalpy, 4-02
equation for flow of, 18-19
flow in nozzles, 8-17
low-pressure heating, pipe sizes, 12-32
moisture, 7-19
purity, 7-19
quality of wet, 4-08
references, 4-29
sampling, 7-20
saturated, pressure table, 4-36
temperature table, 4-34
thermal conductivity, 3-16
superheated, properties (Table), 4-30
supersaturated, 4-06
viscosity, 1-18
Steam-atmosizing oil burners, 7-72
Steam boilers, 7-03
Steam condensers, test code, 19-27
Steam conditions, boiler, 7-05
ship, 15-78
steam engine, effect of, 8-107
turbine, 8-10
Steam consumption, exhaust-heat engine (Table), 12-34
exhaust-heat turbine (Table), 12-34
in refrigeration (Table), 11-35
steam-jet ejector, 9-18
Steam consumption guarantees, steam engine, 8-107
Steam drying in boiler drums, 7-23
Steam-electric plants, cost data (Table), 16-96
Steam engine locomotives, 14-02
Steam engines, ASME test code, 19-03
capacity, 8-102
classification, 8-100
by conditions of operation, 8-100
by construction, 8-100
by type of valve gear, 8-101
by use, 8-102
clearance space, 8-104
commercial mean indicated pressure (Table), 8-103
cylinder condensation, influence of, 8-110
diagram factors (Table), 8-103
economy, 8-107
effect of steam conditions, 8-107
evacuation-type, 8-107
lubrication, 8-111
mean effective pressure, 8-102
mechanical efficiency (Table), 8-110
overload factors (Table), 8-105
piston speed, 8-105
Rankine cycle efficiency (Table), 8-108
references, 8-112
selection, 8-112
ship, 15-78
steam consumption (Table), 8-108
guaranteed, 8-107
wear of cylinder and rings, 8-111
Steam flow in atomizing deaerator, 7-45
Steam-generating equipment, capacity (Table), 7-05
Steam-generating units, 7-01
ASME test code, 19-03, 19-12
Steam heating, direct, 12-24
Steam heating mains, capacities, 12-32
pressure loss, 12-31
Steam injector, locomotive, 14-20
Steam-jet air ejector, 1-50, 9-16
after condenser for, 9-17
ASME test code, 19-29
capacity, 9-18
intercondenser for, 9-17
multistage, 9-17
single-stage, 9-16
steam consumption, 9-18
two-stage, 9-16
Steam-jet compressor, head-capacity characteristic, 1-51
steam consumption, 1-51
thermal efficiency, 1-51
Steam-jet vacuum refrigeration, 11-03
Steam leakage, Martin's formula for, 8-42
Steam locomotives, classification, 14-04
Steam mains, allowable pressure drop (Table), 12-32
insulation of underground, 3-44
Steam plants, marine, 15-78
production expense, 16-94
ship, 15-72
Steam-power cycles, 4-02
Steam purification in boiler drums, 7-23
Steam purity determination, 7-22
Steam quality determination, 7-21
Steam rates, condenser, 8-51
large turbine, 8-68
test code, 10-25
theoretical (Table), 4-42, 8-88
Steam reheating cycle, 7-30
Steam sampling nozzles, types, 7-20
Steam stations, unit investment cost, 16-89
Steam temperature control in boilers, 7-27
Steam turbines, 9-02 (see also Turbines)
INDEX

Steam turbines (continued) application, 8-10
ASME test code, 19-03, 19-18
Steam washing in boiler drums, 7-23
Steel, emissivity, 2-21
properties of, seamless tubing (Table), 6-29
thermal conductivity, 3-14
thermal expansion, 3-11
turbine rotor, 8-39
Steel flumes, water flow through, 5-16
Steel pipe, 6-02
flow of water in, 5-16
Steel-tube economizers, 7-31
Steel tubing, SAE designation (Table), 6-29
seamless, 6-28
Steel wire gage, Washburn & Moen, 16-08
Steering gear, automotive vehicle, 14-84, 14-85
ship, 15-82
Stefan-Boltzmann law, 3-21
Stepanoff’s diagram, for pumps, 5-62
Stiffening effect, turbine bucket centrifugal, 8-37
Stoichiometry, 2-02
Stoke (def), 6-42
Stokers, 7-64
chain-grate, 7-64
characteristics and uses (Table), 2-35
coal, 2-34
Combination overfeed-underfeed, 7-70
Combustion volume, 7-66
double-inclined side-feed, 7-65
inclined front-feed, 7-65
locomotive, 14-18
manufacturers, 7-71
multiple-retort, 7-65, 7-68
overfeed, 7-04, 7-05
single-retort, 7-65, 7-68
spreader, 7-70
Combustion rates, 7-71
fly ash from, 7-93
traveling-grate, 7-64, 7-65
underfeed, 7-65, 7-68
Combustion rates, 7-68, 7-69
for various fuels (Table), 7-64
Stop valves, turbine, 8-50
Storage, cold, 11-14
of perishable products (Table), 11-40
Storage space, refrigerated goods, 11-43
Storage system, pulverized-coal, 7-86
Straight-condensing turbine, 16-11
Straight-line depreciation, 16-92
Stream flow (def), 16-100
Streamline flow, 3-20
Streamlined bodies, drag of, 15-14
Streamlined railroad equipment, air resistance, 14-02
Streamlining factors, locomotive, 14-49
Street lighting, investment in, 16-00
Stress, allowable, pipe (Table), 6-08 (see also Stress)
calculation for pipes (Table), 6-21
determination for aircraft engines, 13-55
in pipes, effect of water hammer on, 6-09
Stress relief in pipe welding, 6-14
Stresses, compressor blade, 1-106 (see also Stress)
disk, Haerle’s method, 8-31
hoop, formula, 6-18
locomotive crankpin, 14-11
mean tangential, rotor, 8-38
pipe line, correction for square corners, 6-19
determination, 6-16
example, 6-17
in steel blades, 8-23
tangential and radial disk, 8-28
turbine disk, 8-28
Stresses (continued)
turbine rotor, 8-38
Stroboscopes, 19-05
Stroke, of typical internal combustion engines (Tables), 15-17, 13-18, 13-19
Strontium, nuclear properties, 17-18
Structural analysis, aircraft, 15-23
Structural materials, aircraft, weights (Table), 15-05
Struts, drag of, 15-15
Stubs’ steel wire gage, 16-08
Studs, material standards for, 6-05
Sub-bituminous coal, composition (Table), 2-30
Substations, 16-49
economic size, 16-23
investment, 16-09
primary, 16-49
secondary, 16-53
Suction head, net positive of pumps, 7-42
Suction lift, reciprocating pumps, 5-73
Suction line pressure drop, compressor, 1-53
Suction lines, capacity, in refrigeration (Table), 11-24
Sulfonated coal in water treatment, 7-60
Sulfur, in aviation fuels, 13-50
Combustion, 2-04
in diesel fuel oil, 13-33
nuclear properties, 17-18
Sulfur dioxide, 11-10
critical-state properties, 3-60
data, 1-40
molar heat capacity (Table), 2-10
properties (Table), 11-15
thermal conductivity, 3-16
viscosity, 1-15
Sulzer Brothers, compound gas turbine cycles, 10-04, 10-24
Superalloys, high-temperature, 10-34
Supercharged cycles, 10-02
Supercharged engines, fuel rate (Table), 10-06
pdiagrams, 10-05
weight, 10-06
Supercharged power plant, diagram, 10-07
Superchargers, aircraft engine, 10-04, 13-50
characteristics of aircraft, 13-50
Elliott-Buehler, 13-09
exhaust-gas turbine, 13-11
gas turbine, 10-04, 13-08
Supercharging, 10-04
aircraft engine, 13-49
Buehler system of, 13-09
definition, 13-08
diesel engine, 13-08
cycle diesel engine, 10-04
high, 13-11
Kadencay system, 13-11
Superheat, effect of feedwater temperature on, 7-28
Superheat correction, for turbine efficiencies (Table), 8-62
Superheated steam, properties (Table), 4-30
Superheater safety valves, setting of, 7-30
Superheater surface, for various superheaters (Table), 7-27
Superheater tubes, thickness of, 7-38
Superheaters, 7-19, 7-24
alloy steel, 7-29
convection, 7-24
damper control of, 7-28
heat-transfer rates, 7-27
integral, 7-24
interdeck, 7-25
locomotive, 14-19
materials for, 7-29
overdeck, 7-25
INDEX

Superheaters (continued) pressure drop in, 7-29 radiant, 7-24 for semienternal boilers, 7-26 separately fired, 7-28 steam-temperature characteristics, 7-24 for straight-tube boilers, 7-25 surface required in, 7-26 temperature control of, 7-28 Superheating, in boilers, 7-24 of steam, 4-03 Supersaturated steam, 4-06 Superstabilization, 8-17 coefficients, 8-18 effect of, 4-05 Wilson limit, 8-18 Supersonic airfoils, lift and drag approximation, 15-33 shapes of, 15-33 Supersonic compressors, 10-39 Supersonic flow around convex corner, 15-32 Supersonic impact pressure, 3-71 Supersonicics, 15-28 Surface area, of coal (Table), 2-33 of pulverized coal, 7-82 Surface condensers, 9-07 air leakage, 9-15 circulating water velocity, 9-09 construction details, 9-12 construction materials, 9-12 design of, 9-10, 9-11 heat-transfer coefficients, 9-08 selection of tube diameter, 9-09 surface in, 9-07 tube data, (Table) 9-09 tube length, 9-09 tube pressure drop, 9-09 two-pipe, dimensions (Table), 9-14 water-box losses, 9-09 Surface conductance, 3-38 thermal, 12-03 with wind, 3-30 Surface of resistance, geometry of, 20-62 Surface tension, common fluids (Table), 5-03 Surfaces, emissivity, 3-39 exposed, heat transfer of, 3-38 heat loss from bare, 3-42 vertical, heat loss from (Table), 3-40 Surge line, axial-flow compressor, 10-39 Surge protection, outdoor substation, 16-51 Suspended solids in feedwater, 7-50 Sweepback angles, airplane wing, 15-10 Switcher, 44-ton light diesel, 14-32 100-ton 800-hp diesel, 14-32 Switches, disconnecting, 16-50 Switchgear, 16-61 assemblies, 16-60 high-voltage, 16-05 low-voltage, 16-62 medium-voltage, 16-64 metal-clad (Table), 16-64 outgoing feeders, 16-55 Switching costs, railroad, 14-43 Switching equipment, high-voltage, 16-50 low-voltage, 16-53 Switching locomotives, 14-43 Symbols, instrumentation diagram (Table), 18-34 Synchronous condenser, operation of, 8-66 Synchronous converters, 16-83 Synchronous generators, parallel operation, 16-20 Synchronous motor-generator sets, characteristics (Table), 16-77 Synchronous motors, power-factor improvement, 16-48 Syphons, locomotive thermic, 14-18 Systems, heating, 12-12 Tables, air, 1-04 theoretical nonextraction heat rate, 8-73 theoretical steam rate (Tables), 4-42, 6-88 Tachometers, 19-04 Tachoscope, 19-04 Tail surface area, aircraft, 15-22 Tailpipe, jet propulsion, 15-55 Take-off power, aircraft engine, 13-52 Take-off speed, aircraft engine, 13-52 Tandem-compound turbine, 8-07 Tangential pulverized-coal burner, 7-88 Tangential stress, disk, 8-28 Tank heaters, oil, 2-56 Tanks, expansion, in hot-water heating, 12-39 oil, capacity and location, 2-55 care of, 2-55 minimum distance between, 2-55 oil storage, 2-54 specifications (Table), 2-54 Tantalum, nuclear properties, 17-18 thermal conductivity, 3-14 Taper of pipe threads, 6-33 Tapped holes, diameter of twist drills (Table), 6-35 Tax statement, Consolidated Edison Co. of N. Y., Inc. (Table), 18-94 Taxes, 16-04 Taylorcraft, Inc., 15-05 Taylor's series, 20-75 Tees, flow resistance of, 6-36 Tellurium, nuclear properties, 17-19 Temperature, absolute, 3-03 cable operating (Table), 16-31 of conductors, effect of size on, 16-34 control of, 18-31 conversion of, 19-02 dew-point, 12-74 dry-bulb, 1-07, 12-74 effect on pipe material (Table), 6-08 furnace, factors affecting, 7-75 gas-flame, calculation, 2-70 maximum for pressure piping, 6-06 methods of measuring, 18-02 radiation pyrometer true (Table), 18-14 standard atmosphere, 15-06 static, 3-65 total, 3-65 wet-bulb, 1-07, 12-74 Temperature characteristics, superheater, 7-24 Temperature coefficient of resistivity, 16-07 Temperature conditions, North American (Table), 9-24 Temperature control, jet propulsion, 15-63 Temperature conversion, °C to °F, °F to °C, 18-03, 18-04 Temperature correction, pressure-column (Table), 18-18 Temperature difference, apparent, evaporators, 3-74 log mean, 7-15, 7-27, 9-08 mean, 3-31 Temperature-entropy diagram, 4-02 air, 1-03 Temperature and humidity, relation between, 12-72 Temperature limits, pipe material (Table), 6-15 Temperature measurement, radiation methods, 18-13 Temperature-measurement transmission, 18-36 Temperature-ratio factor X, for air (Table), 16-45 Temperature rise, blast heater, 12-47
INDEX

Thrust augmentation, jet propulsion, 15-63
Thrust bearing, Kingsbury, 8-40
Thrust calculation, turbojet, 15-58
Thrust coefficient, aircraft propeller, 15-20
Thyline blue, 7-53
Thyrite arresters, 16-40
Tie, conductivity, 11-37
Tin, emissivity, 3-21
nuclear properties, 17-18
Thermal conductivity, 3-14
Titanium, nuclear properties, 17-18
Toe-in, automotive vehicle wheel, 14-85
Toluene, combustion, 2-04
Tolurol red, 7-53
Ton of refrigeration, 11-02
Tonnage, of ships, 15-69
Torque coefficient, aircraft propeller, 15-20
Torque converter, automotive vehicle, 14-83
Torsional vibration, engine, 13-16
engine-generator, 14-18
Torus, geometry of Table, 5-01
Toxic properties, refrigerant (Table), 11-19
Traction generator, locomotive main, 14-29
Traction motors, locomotive, 14-56
Tractive effort, calculation of locomotive, 14-30
locomotive, 14-07
various locomotive types, 14-25
Tractive effort-speed characteristics, locomotive, 14-30
Tractive resistance, electric locomotive, 14-48
Train air resistance, 14-02
Trains, acceleration resistance, 14-04
grade resistance, 14-03
self-propelled, 14-40
Transformers, 16-66
connections, 16-70
distribution, 16-69
price (Table), 16-69
ratings (Table), 16-69
exciting current, 16-67
impedance voltage, 16-67
instrument, 16-73
load loss of, 16-67
load no-load loss of, 16-67
operative and inoperative parallel connections (Table), 16-72
parallel operation, 16-71
polarity, 16-67
power, ratings (Table), 16-70
price of standard power (Table), 16-68
ratings, 16-66
secondary substations (Table), 16-54
turn ratio, 16-66
types, 16-67

Transmission, automotive vehicle, 14-82
flow-measurement, 18-37
level-measurement, 18-37
locomotive mechanical, 14-39
pressure-measurement, 18-37
temperature-measurement, 18-36
Transmission expense, electric power, 16-95
Transmission of heat, references, 3-34
Transmission plant investment, 16-90
Transmission systems, locomotive electric, 15-29
Transmitter controllers, 16-37
Transmitting expansion thermometers, 18-05
Transportation, air and marine, 15-01
land, 14-01
Trapezium, geometry of, 20-58
Trapezoid, geometry of, 20-55
Traveling-grade stokers, 7-64, 7-65
boiler capacity range, 7-05
combustion rate, 7-04
Triangle, equilateral, geometry of, 20-55
goneral, geometry of, 20-55
right, geometry of, 20-55
solution of, 20-65
Trichloroethylene, 11-10
Trichloromethane, 11-03
Trigonometric functions, signs of (Table), 20-63
Trigonometric identities, (Table), 20-64
Trigonometric tables, 20-67
Trigonometry, 20-62
Trusses, 15-02
Triple-expansion steam engines, 8-107
Triplex pump, 5-72
Truck, locomotive, 14-21
Trucks, gross weight, 14-61
Trunk-piston engine, (def), 13-03
Tubaxial fans, 1-58, 1-93
capacity table, 1-89
dimension (Table), 1-89
Tube data, surface condenser (Table), 9-09
tube diameter, surface condenser, section of, 9-09
Tube length, surface condenser, 9-09
Tube materials, condenser, chemical composition of (Table), 9-13
Tube pressure drop, surface condenser, 9-09
Tube sheets, condenser, 9-12
Tube spacing, condenser, 9-12
Tube thermocouples, 18-07
Tubes, coefficient of discharge (Table), 5-10
condenser, 9-12
Pitot, 5-21
seamless steel, 8-28
seamless, thickness of, 7-28
Tubing, commercial, 6-24
pressure loss in, 8-35
seamless, properties of steel used (Table), 6-29
weight per foot (Table), 6-31
Tubular-type feedwater heaters, 7-45
Tungsten, emissivity, 3-21
nuclear properties, 17-19
thermal conductivity, 3-14
Turbidity method in water analysis, 7-54
Turbo-car, 7-51
(see also Turbine)
Turbine capacity, limiting factor in, 8-94
Turbine cycle, 8-14
Turbine deposits, removal of, 8-55
Turbine diaphragms, 8-51
Turbine disk materials, 15-52
Turbinedriven generators, 16-13
Turbine efficiencies, superheat correction (Table), 8-62
Turbine-electric locomotives, 14-26
dimension and weights (Table), 14-28
Turbine exhaust, wetness at, 8-70
Turbine exhaust hoods, 8-52
Turbine exhaust loss, 8-66
Turbine extraction calculations, 8-72
Turbine foundations, 8-52
design and construction, 8-53
Turbine-gear locomotives, dimensions and weights (Table), 14-26
Turbine-generator sets, auxiliary, efficiency of, 8-60
INDEX

Turbine-generator sets (continued)
condensing, dimensions and weights (Table), 16-14
geared, 16-14

Turbine generators, revolving armature, 16-14
revolving field, 16-13
topping, 8-12

Turbine governors, 8-48
Turbine hood loss, 8-70
Turbine internal efficiency, 8-71
Turbine leaving loss, 8-70
Turbine locomotives, 14-24
Turbine oil reservoirs, 8-45
Turbine performance, calculation of, 8-63
steam, 8-57
Turbine performance data, 60,000-kw steam, 8-81
Turbine pumps, 5-76
Turbine rotors, 8-42
Turbine runners, hydraulic, specific speed of, 8-24
Turbine speeds, 8-12
Turbine stage efficiency, 8-71
Turbine stage pressure curves, 8-68
Turbine stages, reaction, 8-21
Turbine wheel efficiency, 8-71
Turbines, AIEE-ASME preferred standard, 8-62
(see also Gas turbines)
AIEE-ASME preferred standards, 60,000-kw unit performance data (Table), 8-82
atmospheric exhaust for, 8-52
automatic extraction, 8-12, 8-88
estimating method, 8-89
pressure control, 8-49
operating conditions, 8-16
casing materials, 8-50
correction factors, 8-56
couplings, 8-41
deposits in, 8-26
disk design, 8-27
disk material, 8-27
dummy pistons, 8-41
economic operating conditions, selection, 8-92
effect of bypassing top heater, 8-63
effect of initial pressure, 8-63
effect of initial temperature, 8-63
effect of vacuum on output (Table), 8-63
efficiency of condensing (Table), 8-61

efficiency of condensing single-automatic-extract (Table), 8-61

efficiency of noncondensing (Table), 8-61
extraction, 8-12, 8-88, 16-11
extraction or regenerative, 8-10
floor space and weight requirements, 8-94
foundation materials, 8-52
geared, efficiency (Table), 8-42
helical-flow, 8-42
horsepower of hydraulic, 8-23
hydraulic, 8-23
fundamental equations, 8-24
impulse, shaft diameters, 8-38
impulse-and-reaction, 8-47
impulse vs. reaction, 8-10
internal efficiency, 8-66
lambda, 8-58
large, steam rates, 8-66
Ljungstrom double-rotation, 8-10
lubricating oil for, 8-46
lubrication of, 8-44
mercury, 16-12
multistage impulse, 8-53
noncondensing, 8-12, 16-11
nozzle materials for, 8-18
oil recommendations for (Table), 8-47
performance of mechanical-drive, 8-58
radial-flow, 8-10

Turbines (continued)
references, 8-98
regenerative-reheat, 8-12
reheat, 8-91
ship, 15-79
simple impulse, 8-22
sizes, 8-10
steam, 8-2
application, 8-10
ASME test code, 19-03
elevation, 8-53
exhaust losses, 8-46
heat consumption, 8-58
mechanical losses, 8-66, 8-69
steam conditions, 8-10
steam piping for, 8-53
straight-condensing, 16-11
tandem-compound, 8-23
thrust for, 15-2

Turbine, total stream extracted from (Table), 8-80
turbojet, 15-52
turning gear, 8-46
types, 8-42
velocity-compounded, 8-02
velocity diagrams, 8-20
velocity ratio, 8-22
vortex design, 15-54
wheel efficiency of impulse, 8-26

Turbo-blowers, dimensions, performance, 1-53
Turbo-charger, Elliott-Buech, 13-09

Turbo-compressors, 1-51
performance of, 1-52
region of stability in, 1-52

Turbo-electric installations, ship, 15-78

Turbo-superchargers, 10-04
General Electric, 13-11
weights of, 10-04

Turbojets, 15-19, 15-40 (see also Gas turbines and Jet propulsion)
Allison, 15-40, 15-41
Amercan (Table), 15-66
Canadian (Table), 15-66
combustion chambers for, 15-52
components, 15-51
compressors for, 15-51
crane, 15-62
design and performance calculations, 15-53
Engle (Table), 15-07
exhaust duct, 15-52
General Electric, 15-41
intake duct, 15-51
pressure ratio, 15-54
propulsion nozzle, 15-53
thrust calculation, 15-53
turbines for, 15-52
variable-area propulsion nozzle, 15-53
Westinghouse, 15-41

Turbine factor, 15-07

Turbulent Flow, 1-22
pressure loss with, 6-36

Turn ratio, transformer, 10-06

Turning gear, turbine, 8-46

Two-dimensional diffusers, 15-34

Two-dimensional shock patterns, 15-50

Two-phase, four-wire circuits, 16-05

Two-row wheel, turbine, 8-40
velocity diagrams for, 8-20

U. S. Coast Guard, 15-72
U. S. gallon, 20-44
U. S. Standard size, 7-85

U tubes, conversion of pressure, 19-09
Ultimate analysis, coal, 2-22
Ultimate strength, tube steel (Table), 6-29
INDEX

Underexpansion in nozzles, losses by, 8-18
Underfeed stokers, 2-34, 7-48
combustion rates, 7-68, 7-69
combustion volume, 7-46
heat-release rates, 7-75
manufacturers, 7-71
Unfired pressure vessels, code, 7-17
Unigird, geometry of, 20-60
Uniflow steam engine, 8-101
Unit coolers, 12-85
Unit heaters, 12-13
capacities (Table), 12-55
constants for determining capacity (Table), 12-56
industrial-type, 12-55
Unit ventilators, 12-14, 12-56
United Helicopters, Inc., 15-25
Units; measures, weights, and (Tables), 20-44
mass, 17-03
thermal, 3-02
Universal calorimeter, 7-22
Universal gas constant, 5-42
Universal joints, 14-86
Unwin equation for flow, 1-30
Uranium, natural, 17-10
nuclear properties, 17-19
Utilization factor (def), 16-100

Vacuum, effect on turbine output (Table), 8-63
Vacuum breakers, 9-02
Vacuum heating systems, mechanical, 12-28
Vacuum pumps, ASME test code, 19-02
dry, performance, 1-48
Hytor (cross section), 1-30
rotary, performance, 1-48
Vacuum refrigerating systems, 11-25
Valve gears, locomotive, 14-16
Valve materials, 6-04
Valve mechanisms, aircraft engine, 13-43
Valve sizes, atmospheric relief (Table), 9-16
Valve springs, automotive engine, 14-67
Valves, air flow through engine, 14-67
aircraft engine, 13-43
atmospheric relief, 9-15
butterfly, 18-27
compressor, 1-44
dimensional standards, 6-05
electric-motor, 18-19
equivalent pipe lengths, 1-33, 1-34
expansion, 11-47
refrigeration, 11-03
flow resistance, 6-36
material specifications, 6-04
pressure loss in, 6-46
for pressure piping, 6-06
pump, 5-73
rating of radiator (Table), 12-29
remote operation, 18-37
rotary-stem, 18-27
slip-stem, 18-27
solenoid, 18-26
thermostatic, 18-24
throttle, 8-49
trim of, 18-27
turbine control, 8-49
turbine stop, 8-50
types of control, 18-27
Valves and fittings, 6-04
equivalent length (Table), 11-23
resistance (Table), 12-31
Vanadium, nuclear properties, 17-18
Vane control, fan, 1-91
Vane-type controller, 18-25
Vaneaxial fans, 1-58, 1-94

Vaneaxial fans (continued)
dimensions (Table), 1-88
Vapor, saturated, 3-60
Vapor barriers, 11-41
Vapor-compression refrigeration, 11-03
Vapor lock, 14-74
Vapor in mixtures, weight, 12-75
Vapor pressure, aviation fuel, 13-50
Vapor heating systems, 12-28
Vaporization, latent heats of (Table), 3-09
Vapors, 3-60
isentropic flow, 3-62
specific heat (Table), 3-05
specific heat ratio (Table), 3-05
thermal conductivity, 3-15
Variable-speed drives, hydraulic coupling, 5-84, 5-85
Variable-stroke pumps, 5-76
Vee-type aircraft engines, 13-42
Vegetables, storage, 11-40
Vehicles, automotive, 14-61 (see also Automotive vehicles)
Velocity, allowable, in ducts, 12-50
allowable, fan systems (Table), 12-60
of approach, 5-18, 5-19
of approach factor, 1-13
dimensions, 5-05
gas-flame, 2-49
metric equivalents (Table), 20-48
piston, 14-69
slip-stream, 15-17
sonic, 15-28
spouting water, 5-09
Velocity coefficient, bucket, 8-19
nozzle, 8-16
Velocity-compounded turbines, 8-02
Velocity constant, $K_v$, for air, 1-79
Velocity diagram, axial-flow compressor, 1-90
centrifugal compressor, 1-52
center of gravity, 1-36
pump, 5-53
selection of axial-flow compressor, 1-103
symmetrical, axial-flow compressor, 1-103
turbine, 8-20
two-row wheel, 8-20
Velocity head, 5-11, 5-12
loss in pipe fittings, 6-36
Velocity meters, 18-19
Velocity and pressure relations, fan practice, 1-79
Velocity ratio, turbine, 8-22
Velocity triangle, Euler's, 5-53
Velox boiler, 10-02, 10-08
Vena contracta taps (flow measurement), 1-16, 18-19
Ventilating, 12-02, 12-71
Ventilating air, cooling of, refrigeration, 11-38
Ventilating fans, outlet velocities and tip speeds (Table), 1-81
Ventilation, crankcase, 14-65
requirements for good, 12-72
ship, 15-82
systems of, 12-71
Ventilation requirements, outside air (Table), 12-71
Ventilators, automatic, 12-72
automatic, air velocities (Table), 12-72
unit, 12-14, 12-56
Vents of closed feedwater heaters, 7-50
Venturi (Turbine) heaters, friction of air through (Table), 12-53
hot-blade, data (Table), 12-47
performance (Table), 12-48
Venturi meter, 5-21
Venturi tube, flow formulas, 1-10
INDEX

Vortex sheet, 15-34
Vortex theory, in turbine design, 8-23
W. S. Tyler sieve, 7-85
Wall thickness, for various pipe sizes (Table), 6-25
Walls, furnace, types of, 7-75
heat flow through, 12-03
heat gain (Table), 12-80
Walshaert valve gear, 14-17
Warm-air heating, 12-40
Warm-air heating systems, forced, 12-44
Warm-air registers, carrying capacity, 12-41
Warner engines, 13-54
Washers, air, 12-75
Waste gas temperatures of industrial furnaces (Table), 7-39
Waste gate, supercharger, 10-04
Waste heat, methods of recovery, 7-39
recovery in sewage-treatment plants, 7-39
utilization of, 7-30
Waste-heat boilers, 7-08, 7-30, 7-39
Water, compressed (Table), 4-37
critical-state properties, 3-60
denmineralization treatment, 7-61
density, 1-15, 4-40, 5-03
equation for flow, 18-20
free convection in, 3-18
kinematic viscosity, 1-15, 5-03
mass density (Table), 5-03
modulus of elasticity (Table), 5-03
properties of compressed liquid, 4-37
spouting velocity, 5-09
surface tension (Table), 5-03
thermal conductivity, 3-15
viscosity, 1-15, 5-03
Water-box losses in surface condensers, 9-09
Water boxes, condenser, 9-12
Water columns, correction for temperature (Table), 19-08
Water-cooled furnace walls, 7-75
Water-cooled metal furnace walls, 7-78
Water-cooled walls, manufacturers, 7-81
Water-cooling equipment, ASME test code, 19-02
Water-cooling system, locomotive engine, 14-30
Water flow, canal, 5-15
in steel flumes, 5-16
in wooden box flumes, 5-16
Water gas, carburetted, 2-04, 2-80
Water gas sets, operating data (Table), 2-81
Water glands, turbine, 8-43
Water hammer, 5-17
allowance for, in pipe, 6-09
Water hardness, tests for, 7-54
turbidity method, 7-54
Water requirements, cooling tower, 9-26
Water-storage capacity, feedwater heater, 7-15
Water systems, jet-pump, 5-79
Water treatment, internal, 7-57
Water-tube boilers, 7-08
wall construction, 7-76
Water vapor, (steam) data, 1-40, 4-30
data at high vacua, 11-25
emissivity, 3-24
molar heat capacity (Table), 2-10
volume per pound of dry air (Table), 9-05
weight per pound of dry air (Table), 9-05
Water vapor and air, mixtures of, 1-02, 1-06
saturated mixtures, 1-07
Waukesha diesel engine, 13-17, 13-19
Waukesha-Hesselman diesel engine, 13-18, 13-19
Wave propagation, Joukowski's equation, 5-17
Waves, expansion, 15-29
Mach, 15-28

Vertical boiler, 7-07
Vertical pulverized-coal burner, 7-88
Vertical surfaces, heat loss from (Table), 3-40
Vibration, aircraft engines, 13-51
blade, axial-flow compressor, 1-106
bucket, 8-21, 8-36
turbine disk, 8-38
Viscosimeter, Engler, 6-43
Saybolt Universal, 6-42
Viscometry, 6-42
Viscosity, 5-02 (def), 6-41 (def)
absolute, 5-02
coefficient, 6-41
common fluids (Table), 5-03
common liquids, 6-43
conversion, 6-42
dimensions, 5-05
dimensions and units, 6-41
dynamic, 5-02
fuel oils, 2-46
gasoline, 2-59
kerosene, 2-59
kinematic, 6-42
conversion, 6-43
dimensions, 6-42
units, 6-42
slag, 2-23
units, 6-41
Viscosity classification, SAE (Table), 14-68
Viocity equivalents (Table), 2-47
Viscosity index, lubricating oil, 13-35
Viscosity of petroleum products, 6-44
Viscous flow, 3-20
pressure loss with, 6-36
Viscous liquids, pumping of, 5-08
Vitallium, 15-52
(cast), composition of, 10-35
Volt, electron, 17-03
Voltage, secondary utilization, 16-25
Voltage dip, maximum, 16-18
Voltage ratings, engine-driven generators, 16-16
Voltage regulation, generators, 16-17
Voltage regulators, direct-acting, 16-20
generator, 16-20
application limits (Table), 16-21
indirect-acting, 16-21
Voltage selection, in power distribution, 16-25
Voltage spread, 16-25
recommended (Table), 16-26
Volume, combustion, liquid fuel, 2-53
cooling tower, 9-27
measures (Table), 20-45
metric equivalents (Table), 20-48
relative, in air tables, 1-02
Volume correction, gas, 2-76
Volume of furnaces, factors affecting, 7-75
Volume of water vapor per pound of dry air (Table), 9-05
Volumes, ratio of, chart, 1-41
Volumetric efficiency (def), 13-45
ammonia compressor, 11-09
chart, 1-42
compressor, 1-43
diesel engine, 13-05
engine, 13-45
reciprocating compressor, 1-42
refrigeration compressor, 11-08
Typical, small compressor, 11-09
Volume casing, centrifugal pump, 5-58
Vondracek formula for heating value, 2-04
Vortex, condition of free, 15-54
Vortex blade design, 10-31
Vortex design, 1-104
turbine, 15-54
INDEX

Waves (continued)
shock, 15-29
Weather Bureau records (Table), 12-02
Weather conditions in North America (Table), 9-24
Weathering of coal, 2-33
Wedge, geometry of, 20-59
Weight, aircraft structural material (Table), 15-05
brass pipe (Table), 6-32
butane, 2-60
copper bars (Table), 16-06
copper pipe (Table), 6-32
Everdur pipe (Table), 6-32
per foot, seamless tubing (Table), 6-31
internal-combustion engines (Tables), 13-17, 13-18, 13-19
measures of (Table), 20-45
metric equivalents (Table), 20-47
propane, 2-60
seamless steel pipe (Table), 6-26
seamless tubing (Table), 6-31
turbin, 8-94
water vapor per pound of dry air (Table), 9-05
welded pipe (Table), 6-26
Weights and dimensions, low-speed generators (Table), 16-19
high-speed generators (Table), 16-19
Wet air, Cippolletti, 5-20
equation for, 5-19
discharge over, 5-11
flow over, 5-18
measuring, 5-19
rectangular, 5-19
triangular notch, 5-20
Welded pipe, dimensions (Table), 6-25
weights (Table), 6-26
Welding, steel pipe, 6-24
pipe, 6-13
procedure, 6-14
stress relief, 6-14
Welds, butt, in pipe, 6-13
fillet, in pipe, 6-14
seal, in pipe, 6-14
Wells, thermometer, 18-07
Westinghouse gas turbine, 10-20, 10-29
Westinghouse turbojet, 15-86
Wet-bottom furnaces, 7-81
Wet-bulb and dry-bulb temperature difference (Table), 3-41
Wet-bulb temperature, 1-07, 12-74
Wetness at turbine exhaust, 8-70
Wetted perimeter, 1-32
Wetted surface, cooling tower, 9-28
Weymouth equation for flow, 1-31
Wheat, heating value, 2-44
Wheel arrangement, diesel locomotive, 14-31
electric locomotive, 14-47
Wheel efficiency, impulse turbine, 8-26
Wheelbase, of buses, 14-61
light cars, 14-61
Wheels, fan, 1-73
locomotive, 14-56
Whyte system, electric locomotive classification (Table), 14-47
Williams line, for turbines, 8-63
Williams and Hazen’s equation for water flow, 5-16
Wilson limit, supersaturation, 8-18
Wind, in U. S. cities (Table), 12-02
Wind conditions in North America (Table), 9-24
Wind velocity for cooling towers, 9-24
Windlass, anchor, 15-82
Windows, infiltration through (Table), 12-10
Wing loading, airplane, 15-17
Wings, rotating, jet propulsion of, 15-42
Wire, electric, 10-73
Wire gage, American, 16-08
Wire gages (Table), 16-08
Wires, drag of, 15-15
Wiring, for diesel engines, 13-21
general plant, 16-74
underground, 16-74
Witte diesel engine, 13-17
Wood, combustion flue-gas analysis (Table), 2-41
combustion properties, 2-40
composition (Table), 2-40
heating value (Table), 2-40
specific gravity, 2-40
thermal conductivity, 11-37, 12-05, 12-09
weight per cord (Table), 2-40
Wool, thermal conductivity, 3-14
Work (def), 3-50
dimensions, 5-05
metric equivalents, 20-49
Work ratio, gas turbine, 10-11
Wright Aeronautical Corporation propjet, 15-68
Wright engines, 15-54
Wrought-iron pipe, 6-02
dimensions (Table), 6-27
weights (Table), 6-28
X-40 alloy (cast), composition, 10-35
Xenon, nuclear properties, 17-19
Yield point, pipe material, 6-03
tube steel (Table), 6-29
Yttrium, nuclear properties, 17-18
Zeolite, 7-59
Zeolite water softener, capacity, 7-59
equations, 7-58
pH value, 7-59
regeneration of, 7-58
Zero pressure gas properties, 3-58
Zeta function, Gibbs’, 3-55
Zinc, emissivity, 3-21
nuclear properties, 17-18
thermal conductivity, 3-14
Zirconium, nuclear properties, 17-18
Zone, spherical, geometry of, 20-61