

SUBJECT INDEX.

- AP 33.** See *Alloys*.
A.R. alloy. See *Alloys*.
AZF. See *Alloys*.
AZG. See *Alloys*.
Abrasion. See *Wear*.
Abrasives
 aluminous, blasting with, 484.
 boron carbide, 259.
 production, 726.
 sources, 726.
 statistics, 726.
 terms, 484.
Accidents, first aid, booklet, 547.
Accumulators, alkaline, manuf., &c., 451.
Acetic acid, corrosion by. See *Corrosion*.
Acetylene. See *Welding*.
Acid-resistant materials (see also under names of alloys),
 comparison, 471.
 for boiling acids, 17.
 testing, book, 491.
Acids. See under names of acids.
Acrite. See *Alloys*.
Adsorbed atoms, migration on solid surfaces, 210.
Adsorption,
 effect on surface friction, 143.
 of gases. See *Gases*.
Aeroplanes. See *Aircraft*.
Affinity, systematic study, 510.
Age-hardening,
 artificial, mechanism, 672.
 bibliography, 583, 673.
 effect of high hydrostatic pressures, 583.
 investigation, appn. of x-rays, 225.
 mechanism, 153; review, 583.
 precipitation, 116; internal stresses resulting from, 583; magnetic study, 95; rate, 284.
 relation to creep, 673.
 relationship of time, temperature, & concentration, 673.
 review, historical, 583.
 theory, 13, 673.
Age-hardening of—
 Aldrey, 371.
 Alloys, effect of cobalt, 13; in creep conditions, 142.
 Aluminium alloys, 538; effect of iron group metals, 569; in recirculating oven, 72; mechanism, 337; review, 672.
 Aluminium-copper alloys, effect on corrosion, 381, 595; magnetic study, 95.
 Aluminium-magnesium alloys, 569, 577, 671.
 Aluminium-zinc alloys, review, 582.
 Binary alloys, effect of third element, 338.
 Brass, 575.
 Calcium-lead alloys, 9.
 Age-hardening of—
 Calcium-lead-sodium alloys, 11.
 Copper-iron alloys, lattice changes during, 149.
 Copper-nickel-silicon alloys, 51, 673.
 Copper-silver alloys, 150.
 Duralumin, 569; after cold-work, 337; effect of cooling rate, 13; effect of high hydrostatic pressures, 583; mechanism, 146.
 Iron-molybdenum alloys, 152.
 Lautal, 672.
 Lead alloys, 9.
 Silumin-Alpha, 672.
 Solid solutions, 583, 681.
 "Y" alloy, 671.
Aircraft,
 construction, development, 713.
 constructional materials, 645, 646;
 book, 191; protection, 473; see also *Alloys*, & under names of metals.
 design, book, 410.
 industry, directory, 544, 648.
 propellers, examination, 109; manuf., 186, 396; oscillations, 449; profiling machine, 182.
 technical reports, internat. index, 651.
 welding. See *Welding*.
 wing spars, design, 186.
Alarcar process, 312.
Albondur. See *Alloys*.
Alclad, protected, corrosion tests, 164.
Aldrey. See *Alloys*.
Aldural. See *Alloys*.
Alkali metals (see also under names of alkali metals),
 adsorbed on hot tungsten, rate of evapn., 93.
 adsorption on metal surfaces, 206, 563.
 detection. See *Analysis*.
 electrical conductivity, effect of pressure, 143.
 electrical resistance, change in magnetic field, 93.
 estimation. See *Analysis*.
 Hall effect, 279.
 molecular weights, 54.
 optical properties, 93, 562, 663.
 photoelectric effect, effect of temp., 563; selective, 563.
 physico-chemical properties, bibliography, 46; review, 46, 205.
 production in U.S.S.R., 739.
 thermal ionization from tungsten & molybdenum, 205.
 thermoelectric force, 456.
 viscosity, 141.
Alkaline earth metals (see also under names of alkaline earth metals),
 detection. See *Analysis*.
Allegheny metal. See *Alloys*.

Allotropy (see also under names of metals),
recrystallization accompanying, 684.
Alloying, origin, 265.

ALLOYS & COMPOUNDS—

ϵ -phases, appn. of Bloch theory, 681.
 η -phases, appn. of Bloch theory, 681.
acid-resisting. See *Acid-resistant materials*, under names of constituent metals, and also *Corrosion*.
age-hardening. See *Age-hardening*.
analysis. See *Analysis*.
atomic arrangement, 379; effect of thermal agitation, 589; orderly, criterion for occurrence, 588.
Barkhausen effect, 581.
binary, appn. of Bloch theory, 681; eutectics, crystn., 511; fracture on deformation, 466; numerical relationships, 589, 590 (see also *Hume-Rothery rule*); valence-electron concn. law, 426; vapour tensions & activities of partly & completely miscible metals in, 377; x-ray analysis at elevated temps., 223.
book, 132 (review).
casting. See *Casting*.
cold-work, recovery from, review, 142.
coloured metal, book, 546; substitutes for tin, book, 547.
complex, recrystn., 512.
compositions, lists, 14, 136 (review), 219, 342.
constitution, book, 132 (review); Hume-Rothery rule, 14, 219, 284, 426, 589, 590; investigation, 510, 583; investigation, magnetic methods, 682; x-ray study at high temps., apparatus, 592.
corrosion. See *Corrosion*.
corrosion-fatigue. See *Corrosion-fatigue*.
corrosion-resistant. See *Corrosion-resistant materials*, under names of constituent metals, & also *Corrosion*.
creep, abnormal, during transformation, 336, 671.
crystal structure, bibliography, 513; book, 87 (review); tables, 513.
crystallization, 683.
decorative, 404.
definite, prepn., 55.
deformation of atoms, 589.
dental. See *Alloys : Dental alloys*.
deposition. See *Deposition*.
die-casting. See *Die-casting*.
directional properties, 55.
electrolytic production, 608, 703.
equilibrium diagrams. See *Equilibrium diagrams*.
eutectics, crystn., 470, 511; effect of pressure, 154.
eutectoid, transformations, reviews, 154.
ferromagnetic. See *Ferromagnetic materials*.
fine structure of x-ray absorption limits, 221, 687.

Alloys & compounds—

for apparatus & machinery, list of compns. & mfrs., 136 (review).
for bells, 624.
for die-casting, 625; selection, 113; specifications, 644.
for electrical heating elements, analysis. See *Analysis*; review, 463.
for electrical resistances, manuf., 725; properties, 375, 377; sputtered, 94; temp.-resistance constants, A.S.T.M. methods of test, 619.
for internal architecture, 644.
for radium beam therapy, 377.
for transport equipment, 284.
fusible. See *Alloys : Fusible alloys*.
grain-size, effect on creep-resistance, 154; effect on high-temp. characteristics, 154; effect on tensile properties, 154.
heat-resistant. See *Heat-resistant materials*, & under names of constituent metals.
heat-treatment. See *Heat-treatment*.
high-strength, 582.
history, 283.
homogeneous, modifications, 209.
Hume-Rothery rule, 14, 219, 284, 426, 589, 590.
idiosyncrasies, 681.
in aircraft, book, 546.
in dentistry, 79 (see also *Alloys : Dental alloys*).
in shipbuilding, 451.
intermetallic compounds, bibliographies, 39, 589; crystal structure, 157; formation, compression in, 155; Hume-Rothery rule, 14, 219, 284, 426, 589, 590; mercury method, 341; methods for detection, 583; modern views, 583; space lattice of "berthollides," 289; structure, review, 589; theory, 155.
inverse segregation, 154.
light. See *Alloys : Aluminium alloys, Magnesium alloys*, & under names of alloys.
low-expansion, 148.
low-melting point, 282, 404.
magnetic, induction melted, booklet, 410; structure, 678.
magnetostrictive, with low temp. coeffs. of frequency, 375.
phase boundary energies in pure electroneutral phases, 586.
phase changes, detn. of gas soly. as guide to, 151.
phase equilibria of third order, 155, 219, 422, 510.
photoelectric effect, external, selectivity, 681.
polynary, formation of compds., detection, 511.
preparation by sintering, 148.
quaternary, equilib. diagr., representation, 465.
radioactive, use in study of metals, 142.
reproducibility of mould shapes, 621.

Alloys & compounds—

segregate structures. See *Widman-statten structure*.

shock-resistance, 369.

single crystals. See *Single crystals*.

solid, reactions in, 342.

solid solutions, accompanied by formation of chem. combination, curves of fusion, 284; age-hardening. See *Age-hardening*; effect of cold-work on elect. resistance, 419; formation, 512; heterogeneity, 584; magnetism & atomic state of, 219; methods for studying thermal changes during transformations, 155; orderly atomic distribution, criterion for occurrence, 588; prodn., adsorptive growth and, 57; supersatd., premature pptn., 13; ternary, elect. conductivity, 584; theory, 99, 155; transformation, theory, 422, 510; undercooled, theory, 219; unstable, with anomalous lattice const., 425.

solution of high melting point metals by low m.p. metals, 584.

statuary, 404.

strength:

weight ratio, 14.

stresses, prolonged, 466.

superconduc-

tive, be-

haviour,

422; magnetic properties & critical

currents, 422, 676; penetration

by magnetic field, 219, 576,

585.

superconductivity, 466, 681; disturb-

ance by elect. current, 219.

super-hard. See *Alloys: Super-hard*,

Tantalum carbide, *Tungsten carbide*,

&c., & under names of alloys:

Carboly, *Pobedit*, *Widia*, &c.

ternary, book, 269; elect. conduc-

tivity, 584; formation of compds.,

detection, 511; vapour tensions &

activities of partly & completely

miscible metals in, 377.

transformations, in solid state, 155;

of second order, 683; temps., 370;

thermal changes during, methods

for study, 155.

ultra-light. See *Alloys: Dowmetal*,

Elektron, *Magnesium alloys*, &c.

weight % mol. % nomograph, 189.

welding. See *Welding*.

with metalloids, prepn., 55.

AP 33.

founding, 671.

properties, 671.

working & heat-treatment, 671.

A.R. alloy, properties, 573.

Acrite, metallographic tests, 57.

Alloys & compounds—

Albondur, corrosion. See *Corrosion*.

Aldrey (see also *Alloys: Aluminium-magnesium-silicon alloys*),

age-hardening. See *Age-hardening*.

cables, 186; breaking length, 186;

conditions of delivery, 541; pro-

perties, 314.

corrosion. See *Corrosion*.

corrosion-fatigue. See *Corrosion-fatigue*.

creep limit, 96.

hardness, effect of heat-treatment, 337.

mechanical properties at low temps., 422.

overhead conductors for tramways, &c., 35.

preparation, comparison of methods, 371.

wire, alternate bend strength, 438; conditions of delivery, 541.

Aldural G. sheet & strip, Brit. Air Min. specifications, 733.

Allegheny metal, corrosion. See *Corrosion*.

Alpax (Silumin) (see also *Aluminium-silicon alloys*),

action of boiling

acids, 17.

action of boiling

linseed oil, 17.

casting. See

Casting of Silu-

min.

castings, properties, 250.

corrosion. See *Corrosion of Silumin*.

effect of impurities, 670.

electrolytic production, direct, 239, 703.

endurance strength of castings, 95.

in gas industry, 78.

melting. See *Melting of Silumin*.

modification, theory, 220, 371.

pressings, properties, 186.

sheet, mech. properties, 671; use in aircraft industry, 671.

solubility of sodium, 462.

thermal conductivity, 462.

welds, impact strength, 77.

Alpax-Alpha (Silumin-a) age-hardening. See *Age-hardening of Silumin-Alpha*.

Alpax-Beta (Silumin-β),

castings, Brit. Air Min. specifications, 487.

mechanical properties, 96.

Alpax-Gamma (Silumin-γ),

castings, Brit. Air Min. specifications, 487.

mechanical properties, 96.

properties, 8.

uses, 8.

Alsichrom, melting point, 148.

Altmag, welding. See *Welding*.

Aludur, effect of impurities, 670.

Alloys & compounds—

Alufont,

castings, use in large arc furnaces, 639, 732.

tensile properties, 50.

Alumag,

corrosion. See *Corrosion*.
properties, 231.

Aluman, roofing, 123.

Alumina, estimation. See *Analysis*.Aluminium alloys (see also *Alloys* :
A.P. 33, Aldrey, Alpax, Altmag,
Alufont, Alumag, Aluman, Anti-
corodal, B.B., Birmabright, Cer-
alumin, D.M. 31, Duralite, Dur-
alumin, Hiduminium, Hydronalium,
K.-S. Seewasser, Lautal, Magnalium,
Mangal, N.A., Nural, Peratuman,
Webbite, Y-alloy),

age-hardening. See *Age-hardening*.

analysis. See *Analysis*.

annealing. See *Annealing*.

anodic oxidation. See *Anodic oxida-
tion*.

antifriction, as substitute for tin-base
Babbitt, 569.

atomic properties, 213.

bars, Brit. Air Min. specifications, 733.

bibliography, 1.

binary, correlation of equilib. con-
ditions, 7, 94; effect of addns.,
504; high-grade, search for, 504;
review, 461.

book, 266.

cast, improvable by heat-treatment,
148; tensile properties compared
with iron & steel, 50.

castability, 177.

casting. See *Casting*.

castings, design, 177; industry in
1934, 543; properties, 250; shrink-
age, 95; shrinkage cracks, 29.

chromium-plating. See *Deposition*.

colouring. See *Colouring*.

compositions, 1.

constitution, book, 132 (review).

containing iron, elect. resistance after
heat-treatment, 213.

corrosion. See *Corrosion*.

creep, 336, 671.

cylinder heads, 262.

cylinders, I.C.E., 79.

decorative metalwork, 402.

die-casting. See *Die-casting*.

die-castings, Brit. Air Min. speci-
fications, 486.

dimensional stability, effect of elevated
temps., 95.

doors, 187.

drawing. See *Drawing*.

drilling. See *Drilling*.

effect of heat-treatment, 396.

effect of impurities, 670; review, 569.
effect of titanium compounds, 126,
542.

electrical resistance, effect of iron, 213.

electrode potentials of structural com-
ponents, 427.

endurance strength of castings, 95,
281.

Alloys & compounds—

Aluminium alloys,

fabricating characteristics, 1.

fatigue, effect of notches, 5.

for casting, heat-treatable, 96; review,
372.

for die-casting, 251.

for pistons, compn., 51; properties
at high temps., 51; structure, 51.

forging. See *Forging*.

foundry characteristics, 1.

gas cylinders, 262, 732.

grinding. See *Grinding*.

handbook, 491.

heat-treatment. See *Heat-treatment*.

high-strength, 582.

history, 731.

homogeneity, study by coloured indi-
cators, 158.

identification by chem. methods,
106.

in aircraft, 645; requirements, 1.

in aircraft motors, 403.

in architecture, requirements, 1.

in automobiles, 127, 639; require-
ments, 1.

in electric motors, 78.

in funicular railway, 732.

in household appliances, 1.

in machine construction, 401.

in military bridges, 542.

in Naval machinery, 37.

in railway work, 124, 315; require-
ments, 1.

in shipbuilding, 79, 449.

in transport, 79, 185, 186, 732.

LIV. See *Alloys* : *Lautal*.

lattice constitution, 213.

literature, review, 281.

loom pickers, 124.

machining. See *Machining*.

magnetic susceptibility, 51.

mechanical properties, 1; effect of
compn., 212, 337, 671.

melting. See *Melting*.

metallographic etching, 682.

metallography, book, 132 (review).

microstructure, 284.

milling. See *Milling*.

nickel plating. See *Deposition*.

painting. See *Painting*.

pistons, 262; development of design,
449; Elnural process for manuf.,
401.

plating on. See *Deposition*.

polishing. See *Polishing*.

precipitation-hardening. See *Age-
hardening*.

pressing. See *Pressing*.

pressings, in transport, 186.

protection, 103; see also *Anodic
oxidation*, *Deposition*, *Painting*, *Pro-
talyzing*, &c.

protective coatings on, prodn., 158.
qualities, test, 1.

R.R. See *Alloys* : *R.R. alloys*.

riveting. See *Riveting*.

rods for locomotives, 541.

rolling. See *Rolling*.

roofing, 123.

Alloys & compounds—

Aluminium alloys,

rotor conductors, cast, 541, 639.

sand-castings, Brit. Air Min. specifications, 486.

sawing. See *Sawing*.

screw stock, free-cutting, 396, 446.

self-hardening, 51.

service characteristics, 1.

sheets, Brit. Air Min. specification, 733.

ski-stocks, 187.

soldering. See *Soldering*.

solid solubility curve, detn., 7.

solubility of sodium, 462.

standards, German, 261, 541.

strip, Brit. Air Min. specification, 733.

surface treatment, 1, 61, 519, 523, 695; see also *Anodic oxidation*,*Deposition*, *Painting*, &c.

technology, books, 411, 493.

thermal conductivity, 462.

thermal expansion, book, 193 (*review*).

trade designations, 1.

turning. See *Turning*.

uses, 34, 185, 731; in German industry, 541; see also entries above.

volume changes, on solidification, 279.

welding. See *Welding*.wire alloy 3. See *Alloys: Aldrey*.working, book, 194 (*review*).

wrought, for structural appns., 639; manuf., 70.

Y. See *Alloys: Y-alloy*.

Aluminium-barium alloys, constitution, 461.

Aluminium-brasses,

hardness, effect of addns., 505.

oxidation, 515.

Aluminium—"bronzes" (see also *Alloys:**Aluminium-copper alloys*), α -, mech. properties, 418.casting. See *Casting*.constitution, β -transformation, 512; see also *Alloys: Aluminium-copper alloys*.corrosion. See *Corrosion*.die-casting. See *Die-casting*.forging. See *Forging*.

grain-size, relation to dendrite fineness, 585.

hardening, phenomena, 372, 572.

hardness, effect of addns., 505.

mechanical properties, 338, 582; effect of addns., 149.

moulding. See *Moulding*.

oxidation, 515.

paint. See *Aluminium*.

powders, 544.

structure, 97.

uses, 338.

valve seats, wear, 126.

Aluminium-cadmium-magnesium alloys,

constitution, 670.

wrought, mech. properties, 373.

Aluminium-cadmium-magnesium-zinc

alloys, wrought, mech. properties,

373.

Aluminium-cadmium-zinc alloys, pro-

perties, 372.

Alloys & compounds—

Aluminium-carbon system, constitution, 461.

Aluminium-chromium alloys, thermal expansion, 193.

Aluminium-chromium-cobalt-iron alloys, heat-resistant, 571.

Aluminium-chromium-iron alloys (see also *Alsicrom*, *Kanthal*, *Megapyr*, *Permatherm*),

electrical properties, 571.

heat-resistant, 570, 571.

wires, for electrical heating, 570, 571.

Aluminium-chromium-nickel alloys, thermal expansion, 193.

Aluminium-cobalt alloys, thermal expansion, 193.

Aluminium compounds, book, 132 (*review*).

Aluminium-copper alloys (see also

Alloys: Aluminium—"bronzes"),age-hardening. See *Age-hardening*.casting. See *Casting*.constitution, 7, 145, 284, 573; β -

transformation, 282; intermediate

phase in hypereutectoid alloys,

673; solid soly. of copper, 94.

corrosion. See *Corrosion*.CuAl₂, mechanism of pptn., 512.

deformation resulting from heat-treatment, 461.

diffusion of copper from, into pure aluminium coatings, 146.

electrical conductivity, 571, 676.

electrical resistance, effect of pptn.-hardening, 370.

electrolytic production from waste, 608.

foundry practice, 622.

hardness, effect of quenching strains, 7, 95.

improvement by addn. of magnesium, 145.

inverse segregation, 154.

lattice parameter, effect of quenching strains, 7, 95.

magnetic susceptibility, 51; change during ageing, 95.

properties, 622.

solid solubility of copper, effect of surface strain, 94; effect of time of annealing, 146.

solid solutions, supersatd., decompn. as result of plastic deformation & annealing, 670.

specific heat, true, 370.

structure, effect of purity of aluminium, 1.

thermal conductivity, 571, 676.

thermal expansion, 193.

thermal resistance, effect of pptn.-hardening, 370.

volume changes on solidification, 154.

Aluminium-copper-iron alloys (see

also *Alloys: Corrix*),Al₂Cu₂Fe, 511.

hardeners, prodn., 30.

Aluminium-copper-magnesium alloys,

Al₂Mg₂Cu, 511; isomorphism, 593.

mechanical properties, 145.

Alloys & compounds—

Aluminium—copper—magnesium—zinc alloys, solid solns., 593.

Aluminium—copper—manganese alloys (see also *Alloys : Heusler's alloys*), hardeners, prodn., 30.

Aluminium—copper—manganese—tin alloys, properties, 675.

Aluminium—copper—nickel alloys,

Al_3NiCu_2 , 511.

constitution, 338.

mechanical properties, 341, 678.

wrought, properties, 338.

Aluminium—copper—silicon alloys (see also *Alloys : Lantal*), constitution, 7.

Aluminium—copper—tin alloys, properties, 674.

Aluminium—copper—titanium alloys, constitution, x-ray study, 686.

Aluminium—copper—zinc alloys. See *Alloys : Aluminium-brasses*.

Aluminium—gallium alloys,

constitution, 146.

magnetic susceptibility, 51.

Aluminium—germanium alloys, magnetic susceptibility, 51.

Aluminium—gold alloys, crystal structure of cubic phase, 468.

Aluminium—indium alloys, magnetic susceptibility, 51.

Aluminium—iron alloys,

compounds, 341.

decomposition, 146.

electrolytic preparation, 64.

FeAl_3 , crystal structure, 99, 406, 423, 512.

non-metallic inclusions, 282, 681.

oxidation-resistance at high temps., 147.

physical properties, 213.

thermal expansion, 193.

transformations, 279, 671.

Aluminium—iron—carbon alloys, constitution, 213.

Aluminium—iron—nickel alloys,

analysis. See *Analysis*.

bibliography, 39.

magnetic reluctance, 579.

with high coercive strength, 579.

Aluminium—iron—silicon alloys,

$\text{Al}_3\text{Fe}_2\text{Si}_3$, 511.

constitution, 147, 337.

Aluminium—lithium alloys, magnetic susceptibility, 51.

Aluminium—magnesium alloys (see also *Alloys : Birmabright*),

age-hardening. See *Age-hardening*.

burning, light from, 655.

constitution, solid soly. of magnesium, 371; soly. of aluminium, 568, 677.

corrosion. See *Corrosion*.

electrolytic production in cryolite bath, 608.

grain-size, relation to dendrite fineness, 585.

in shipbuilding, 449.

magnetic susceptibility, 51.

mechanical properties, effect of compn., 280, 462; effect of purity, 280, 462, 503.

Alloys & compounds—

Aluminium—magnesium alloys,

oxidation, 515.

precipitation reactions, 569, 671.

protected, corrosion tests, 164.

quenching stresses, 569, 671.

reflectors, in astronomy, 640.

solid solutions, decompn., kinetics,

568; mech. properties, 280; supersatd., decompn., 8.

specific heat, true, 370.

ultra-light, structural, 8.

welding. See *Welding*.

wrought, mech. properties, 373.

Aluminium—magnesium—silicon alloys (see also *Alloys : Aldrey*),

constitution, 508.

Aluminium—magnesium—zinc alloys,

constitution, solid soly. of MgZn_2 , 671.

hardening, 503.

improvement, book, 40.

$\text{Mg}_3\text{Zn}_2\text{Al}_2$, isomorphism, 593.

properties, 578; effect of low temp., 645.

solid solutions, supersatd., decompn., 8.

Aluminium—manganese alloys, magnetic susceptibility, 51.

Aluminium—manganese—tin alloys,

constitution, 50, 147, 281.

properties, 50, 147, 281.

segregation, 50, 147, 281.

Aluminium—Monel metal, mech. properties, 341.

Aluminium—nickel alloys, constitution, 95.

Aluminium oxide, estimation. See *Analysis*.

Aluminium—silicon alloys (see also *Alloys : Alpac (Silumin), Nural, &c.*),

castings, Brit. Air Min. specifications, 487.

constitution, 7, 573; solid soly. of silicon, 96, 213.

corrosion. See *Corrosion*.

crystal structure (normal & modified), 378.

electrolytic production, direct, 703.

mechanical properties, 96; effect of compn., 212, 337, 671.

modification, 371.

pistons, developments, 640.

segregation, prevention, 147.

solid solutions, decompn., kinetics, 570, 671.

thermal expansion, 193.

Aluminium—silver alloys

$\delta \rightarrow \gamma$ reaction, 342.

constitution, 679.

crystal structure of cubic phase, 468.

decomposition, 342.

electrical conductivity, effect of time, 342.

magnetic susceptibility, 51.

Aluminium—tin alloys, properties, 375.

Aluminium—titanium alloys (see also *Webbite*),

constitution, 147.

electrolytic production, 608.

Alloys & compounds—

- Aluminium-zinc alloys**,
 age-hardening. See *Age-hardening*.
 constitution, 592; eutectoid trans-
 formation, 50; eutectoidal de-
 compn. of β -phase, 13, 681; x-ray
 analysis of β -phase, 157, 686;
 x-ray study, 147, 503.
corrosion. See *Corrosion*.
 creep, abnormal, during transforma-
 tion, 336.
 inverse segregation, 154.
 magnetic susceptibility, 51.
 pipes, in water & gas services, 738.
 thermal expansion, 193.
 volume changes on solidification, 154.
- Amalgams**. See *Alloys: Mercury alloys*.
- Ampco**, uses, 487.
- Anticorodal**,
 castability, 177.
 clamp for free transmission lines,
 35.
 forging. See *Forging*.
 pressing. See *Pressing*.
 pressings, properties, 186.
 ski-stocks, 187.
- Anti-friction alloys**. See *Alloys: Bear-
 ing alloys, White metals, &c., &
 under names of constituent metals*.
- Antimony alloys**. See also *Alloys: Babbitt metals, Bearing alloys, White metals, &c.*
- Antimony-cadmium alloys**,
 CdSb, free energy & heat of formation,
 463, 672.
 constitution, 435.
 electrode potentials, 435.
- Antimony-copper alloys**, crystal struc-
 ture of Cu_3Sb , 593.
- Antimony-copper-iron alloys**, constitu-
 tion, 149.
- Antimony-copper-tin alloys** (see also
Alloys: Pewter, &c.),
corrosion. See *Corrosion of Tin-
 antimony-copper alloys*.
- Antimony-iron alloys**, constitution, 672.
- Antimony-lead alloys**,
 buffing. See *Buffing*.
corrosion. See *Corrosion*.
 creep strength, 576.
 electrochemical behaviour in storage
 cells, 528, 703.
 shrinkage, 576.
 tubes, tensile properties, 215, 507.
- Antimony-lead-tin alloys**,
 constitution, 373.
 in suspension bridges, 735.
- Antimony-lead-zinc alloys**, in suspension
 bridges, 735.
- Antimony-magnesium alloys**, miscibility
 of Mg_3Sb_2 and Sb_2Zn_3 , 98.
- Antimony-magnesium-tin alloys**, corro-
 sion. See *Corrosion*.
- Antimony-magnesium-zinc alloys**,
corrosion. See *Corrosion*.
 properties, 578.
- Antimony-platinum alloys**, constitution,
 216.
- Antimony-thallium alloys**, crystal struc-
 ture of Tl_3Sb_2 , 16.

Alloys & compounds—

- Antimony-tin alloys**,
 constitution, 594.
corrosion. See *Corrosion*.
 crystal structure, 594.
 single crystals. See *Single crystals*.
- Antimony-tin-zinc alloys**,
 activity of zinc, 377.
 constitution, 337.
- Antimony-zinc alloys**,
 miscibility of Mg_3Sb_2 & Sb_2Zn_3 , 98.
 vapour tension & activity, 377.
- Armite**, 313.
- Arsenic-cadmium alloys**, crystal struc-
 ture, 594.
- Arsenic-cobalt alloys**, crystal structure,
 593.
- Arsenic-iron alloys**,
 crystal structure, 593; of Fe_2As , 593.
- Arsenic-lead alloys**, constitution, 507.
- Arsenic-magnesium-zinc alloys**, proper-
 ties, 578.
- Arsenic-manganese alloys**, crystal struc-
 ture, 593.
- Arsenic-nickel alloys**, Ni_3As_2 , two-dimen-
 sional superstructure, 378.
- Arsenic-tin alloys**,
 constitution, 594.
 crystal structure, 594.
- Arsenic-zinc alloys**, crystal structure,
 594.
- Asarcology No. 7**, 463.
- Avional**. See *Alloys: Duralumin*.
- AZF**, 71.
- AZG**, 71.
- B.B. alloy**,
 composition, 728.
 welding. See *Welding*.
- Babbitt metals** (see also *Alloys: Bearing alloys, White metals, &c.*, & under names of constituent metals),
 analysis. See *Analysis*.
 bearings, pouring v. spraying, 643, 644.
 bonding to steel & bronze, 53.
 cracking in severe service, 10, 12.
 effect of low temperatures, 420.
 effect of lubricants, 487.
 failure in severe service, 53.
 melting furnaces. See *Furnaces*.
 phases, x-ray study, 11.
 pounding tests, 12.
 Russian standards, 644.
 spraying. See *Spraying*.
 tin-base, substitute for, 569.
 wear, 109, 152.
- Bahnmetall**. See *Calcium-lead-sodium alloys*.
- Barium-mercury alloys**, electrode poten-
 tial, 704.
- Barium-nickel alloys**, properties, 215.
- Barium-thallium alloys**, crystal struc-
 ture, 589.
- Barronia**, corrosion. See *Corrosion*.
- Bearing alloys** (see also *Alloys: Babbitt metal, Bronzes, Gilevor, Satco, White metals, &c.*, & under names of constituent metals),
 aluminium-base, 569.
 analysis. See *Analysis*.
 brass, compared with bronze, 214.

Alloys & compounds—

Bearing alloys,

bronze, thermal expansion, pamphlet, 84.

cadmium-base, 463, 733; properties, 213.

comparison, 464.

compositions, 582.

constitution. See under names of constituent metals.

effect of lubricants, 487.

failure, 464.

finishing, apparatus for, 361.

for centrifugal fans, tests, 340.

for severe service, improvement, 10, 12.

friction & lubrication, 582.

initial wear, 55.

lead-base, hardened with alkali & alkaline earth metals, properties, 52; hardening, 507; indentation tests, effect of flow, ageing, & prolonged heating, 11; pounding tests, 12; properties, 36, 282, 676; tensile tests, 11; uses, 36; with high copper content, 215.

lubrication, 464.

mechanical properties, effect of low temps., 420.

metallographic etching, 682.

properties, review, 451.

requirements, 464.

review, 464.

selection, 451.

service conditions, 464.

stress distribution, 464.

structure, significance, 582.

testing. See *Testing*.

tin-base, failure in railway axles, 12; indentation tests, effect of flow, ageing, & prolonged heating, 11; pounding tests, 12; tensile tests, 11.

wear, 464.

white metal, behaviour when subjected to deformation tests, 11; Brit. Air Min. specification, 488; casting. See *Casting*; cracking, 10, 12, 36; for severe service, improvement, 10, 12; importance of physical structure, 582; indentation tests, effect of flow, ageing, & prolonged heating, 11; pounding tests, 12; tensile tests, 11.

Beryllium alloys,

atomic properties, 213.

lattice constitution, 213.

properties, 41.

review, 672.

uses, 41, 403.

Beryllium—"bronzes" (see also *Beryllium-copper alloys*),

in machine construction, 505.

mechanical properties, 505, 572.

physical properties, 505.

Beryllium-copper alloys,

constitution, compounds, 463; x-ray analysis of β -phase, 157, 686.

corrosion. See *Corrosion*.

crystal lattice distortion, 592, 686.

heat-treated, 420.

Alloys & compounds—

Beryllium-copper alloys,

heat-treatment. See *Heat-treatment*.

manufacture, 673.

mechanical properties, 673.

metallography, 673.

moulds for plastics, 734.

physical properties, 673.

soldering. See *Soldering*.

uses, 673.

wear, 673.

welding. See *Welding*.

Beryllium-copper "bronzes." See

Alloys: Beryllium-copper alloys.

Beryllium-copper-nickel alloys, cutting

tools, non-sparking, 643.

Beryllium-copper-tin alloys, constitu-

tion, 150, 675.

Beryllium-gold alloys, crystal structure

of AuBe_2 , relation to cubic AB, structure, 593.

Beryllium-iron alloys,

constitution, 338, 697; compounds, 463.

Beryllium-nickel alloys, compounds, 463.

Beryllium-palladium alloys, crystal struc-

ture of PdBe_2 , relation to cubic AB, structure, 593.

Birmabright,

cruiser, 79.

sheet and strip, Brit. Air Min. specification, 733.

Birmasil Special, castings, Brit. Air Min.

specifications, 733.

Bismuth alloys,

single crystals. See *Single crystals*.

uses, 733.

Bismuth-cadmium alloys,

density, 281.

electrical resistance, 281.

Hall effect, 281.

specific heat, 281.

thermoelectric power, 281.

Bismuth-cadmium-thallium alloys, con-

stitution, 680.

Bismuth-gold alloys,

Au_2Bi , crystal structure, 378.

constitution, 378.

Bismuth-lead alloys,

diamagnetism, 681.

electrical conductivity, 681.

superconductivity, 422, 676.

Bismuth-lead-thallium alloys, constitu-

tion, 680.

Bismuth-lithium alloys,

constitution, 343.

crystal structure, 589.

Bismuth-magnesium-zinc alloys, proper-

ties, 578.

Bismuth-thallium alloys,

constitution, γ -phase, 680.

crystal structure, 61, 218.

electrochemical study, 218.

superconductive, penetration by magnetic field, 219, 576, 585.

superconductivity of Bi_2Te_3 , 585, 681.

Bismuth-tin alloys,

diamagnetism, 681.

electrical conductivity, 681.

properties, 375.

Alloys & compounds—**Blekor**, durability, 582.**Borium** (see also *Tungsten carbide*), durability, 582.**Boron carbide**, as abrasive, 397.

impact abrasion hardness, 510, 681.

Brass(es) (see also *Alloys : Aluminium-brasses, Lead-brasses, Manganese-brasses, Nickel-brasses, Tungum, &c.*, & under names of constituent metals), α -, cold-rolled, hardness & lattice distortion, 157; crystal lattice distortion, 686; deformation lines, 15; single crystals. See *Single crystals*. $(\alpha + \beta)$, effect of manganese, 676. β -, transformation, 675; transformation point, effect of nickel, 215; wire, effect of method of working on crystal orientation, 16.**Admiralty**, prevention of corrosion in oil refineries by use of ammonia, 697.age-hardening. See *Age-hardening*.**aluminium-**. See *Alloys : Aluminium-brasses*.analysis. See *Analysis*.annealing. See *Annealing*.

bearing properties compared with bronzes, 214.

bolts, impact & static tensile properties, 339.

book, 82.

borings, sepn. from white metal, 179.

buffing. See *Buffing*.casting. See *Casting*.

casting skin, removal from rolling bars, 535.

cold-worked, x-ray line sharpness, relation to high-temp. stability, 16.

colouring. See *Colouring*.

"composition," castings, A.S.T.M. specifications, 125.

constitution. See *Alloys : Copper-zinc alloys*.corrosion. See *Corrosion*.

creep, abnormal, during transformation, 336; correlated with x-ray line broadness, 16.

crystal lattice, fine structure of x-ray absorption edges of copper & zinc, 221.

deep-drawing. See *Drawing*.degassing. See *Degassing*.

density measured by x-rays, 9.

deoxidation. See *Deoxidation*.deposition. See *Deposition*.die-casting. See *Die-casting*.

diffusion of zinc, 209.

drawn cups, crystal orientation, 15.

effect of aluminium. See *Alloys : Aluminium-brasses*.effect of iron. See *Alloys : Copper-iron-zinc alloys*.effect of lead. See *Alloys : Lead-brasses*.effect of manganese. See *Alloys : Manganese-brasses*.**Alloys & compounds—****Brass(es)**,effect of nickel (small amts.), 52; see also *Alloys : Nickel-brasses*.effect of silicon. See *Alloys : Silicon-brasses*.

elastic modulus, 667.

elongation values, 27.

fatigue, at low temps., 355, 714; effect of atmospheric action, 383.

for plumbing, quality & uses, 125.

French, 219.

forging. See *Forging*.

gas absorption, prevention by elect. melting, 716.

grain-growth during recrystn., 587, 684.

grain-size, relation to dendrite fineness, 585.

heat-treatable, pamphlet, 128.

hot-working, 181.

impact strength at high temp., effect of iron, aluminium, & silicon, 339.

in air-conditioning plant, 487.

in food industries, 734.

in water services, 316.

industry in 1935, 127.

internal stress in rods, effect of reduction in area & shape of die, 181.

lead-. See *Alloys : Lead-brasses*.manganese-. See *Alloys : Manganese-brasses*.

mechanical properties at low temps., 501.

melting. See *Melting*.nickel-. See *Alloys : Nickel-brasses*.

oxidation, 515.

penetration of steel, 726.

photoelectric thresholds in turned state, 93.

pipes, installation, &c., in plumbing services, 735.

pressing. See *Pressing*.

properties, book, 411 (review).

protection of screws against oxidation, 231.

recrystallization, 587.

red, cast, mech. & phys. properties, 282.

reference book, 735.

rods, cold-drawn, effect of reduction of area & shape of die on internal stress & tensile properties, 181.

rolling. See *Rolling*.

rolling texture, 15, 100, 289.

scrap, treatment, 72, 441.

season-cracking, 664; prediction of immunity, 16; x-ray analysis, 505.

segregation in cast bolts & bars, 463.

service pipes, suitability, 518.

shrink fits, frictional resistance, 97.

silicon-. See *Alloys : Silicon-brasses, & Copper-silicon-zinc alloys*.single crystals. See *Single crystals*.

67 : 33, effect of temp. & annealing time on structure & mech. properties after cold-working, 574.

soldering. See *Soldering*.

solid viscosity, 336.

special, foundry practice, 717.

specific heat, true, 370.

Alloys & compounds—

Brass(es),

- spraying. See *Spraying*.
- stamping. See *Stamping*.
- statistics, U.S.A., 734.
- tensile properties, of flat test-pieces, 151; of rods, effect of reduction in area & shape of dies, 181.
- thermal conductivity, effect of cold-work, 277; of bars, 14.
- torsion diagram, 356.
- tubes, drawing. See *Tube-drawing*;
- hydraulic tests, 153; tensile properties, 153.
- valve seats, wear, 126.
- welding. See *Welding*.
- wire-drawing. See *Wire-drawing*.
- yellow, effect of lead, 574.
- zinc loss on heating, 90.

Britannia metal,

- buffing. See *Buffing*.
- preparation, 625.
- properties, 625.
- tarnishing, 19.

Bronze(s) (see also *Alloys : Beryllium-bronzes, Caro bronze, Gun-metal, Lead-bronzes, Nickel-bronzes, Phosphor-bronze, Silicon-bronzes, Zinc-bronzes, &c.,* & under names of constituent metals),

- α -, constitution, x-ray studies, 56, 289.
- aluminium-. See *Alloys : Aluminium-"bronzes" & Aluminium-copper alloys*.

- anient, analyses, 611; Chinese, chem. study, 318, 647; Egyptian statuary, technique of prodn., 739; smelting, 127; Swedish, 265.

- annealing. See *Annealing*.

- at elevated temperatures, tests, 339, 675.

- bearing, sliding properties, 316; thermal expansion, pamphlet, 84.

- bearing liners, effect of zinc, 214.

- beryllium-. See *Alloys : Beryllium-"bronzes."*

- bolts, impact & tensile static properties, 339.

- cables, breaking length, 186.

- casting. See *Casting*.

- castings, bibliography, 358; factors influencing density, 358.

- centrifugally-cast, treatment, 307.

- coinage, effect of bismuth, 52.

- colouring. See *Colouring*.

- constitution, 96; see also *Alloys : Copper-tin alloys*.

- corrosion. See *Corrosion*.

- creep, abnormal, during transformation, 336.

- creep-strength, 339.

- degassing. See *Degassing*.

- deoxidation. See *Deoxidation*.

- dilatometric study of castings, 505.

- effect of additions, 573, 674.

- effect of casting temperature, 177.

- effect of lead. See *Alloys : Lead-bronzes*.

- effect of manganese. See *Alloys : Copper-manganese-tin alloys*.

Alloys & compounds

Bronze(s),

- effect of nickel, 52; see also *Alloys : Nickel-bronzes*.

- effect of zinc. See *Alloys : Zinc-bronzes*.

- 88 : 10 : 2. See *Alloys : Gun-metal*.

- embrittlement, 339.

- forging. See *Forging*.

- founding, 251.

- fracture, yellow & brown spots, 177.

- gas absorption, prevention by elect. melting, 716.

- grain-size, relation to dendrite fineness, 585.

- hardening, 505.

- heat-treatable, pamphlet, 128.

- heat-treatment. See *Heat-treatment*.

- high-tin, heat-treated, 282.

- history, 37, 80.

- in engineering, 316.

- in food industries, 734.

- lead-. See *Alloys : Lead-bronzes*.

- manganese-. See *Alloys : Manganese-brass*.

- mechanical properties at low temps., 501.

- medals, manuf., history, 187.

- melting. See *Melting*.

- nickel-. See *Alloys : Nickel-bronzes*.

- porosity, of castings, 177, 675.

- phosphor-. See *Alloys : Phosphor-bronzes*.

- propellers, filling cavitation holes by spraying, 603; for high-speed boats, 449.

- properties, 573.

- removal of zinc, 440.

- segregation, 505.

- silicon-. See *Alloys : Silicon-bronzes*.

- smelting, primitive, 127.

- soldering. See *Soldering*.

- special, properties, 674.

- specific heat, true, 370.

- spraying. See *Metal spraying*.

- stamping. See *Stamping*.

- statistics, U.S.A., 734.

- statuary, ancient Egyptian, technique of prodn., 739; care & preservation, 472.

- structure, 97.

- tensile properties, effect of heat-treatment, 505.

- tinless, 373.

- trolley wire, wear & fatigue, 641.

- valve, castings, A.S.T.M. specifications, 124.

- welding. See *Welding*.

- wires, alternate bend strength, 438.

Cadmium alloys,

- atomic properties, 213.

- bearing, 463, 733; properties, 213.

- casting. See *Casting*.

- lattice constitution, 213.

Cadmium-copper alloys,

- constitution, limits of α -phase, 673.

- corrosion. See *Corrosion*.

- properties, 338.

- trolley wire, wear & fatigue, 641.

Alloys & compounds—

- Cadmium-copper-silver alloys, antifriction, useful ranges, 503. bearing properties, 96. constitution, 282.
- Cadmium-lead-thallium alloys, constitution, review, 153.
- Cadmium-lithium alloys, constitution, 343. crystal structure, 589.
- Cadmium-magnesium alloys, complex, properties, 373. oxidation, 515. photo-tubes, 733. wrought, mech. properties, 373.
- Cadmium-magnesium tin alloys, corrosion. See *Corrosion*.
- Cadmium-magnesium-zinc alloys, corrosion. See *Corrosion*. properties, 578. wrought, mech. properties, 373.
- Cadmium-nickel alloys, bearing, 463. constitution, 96.
- Cadmium-phosphorus alloys, crystal structure, 594.
- Cadmium-silver alloys, bearing, for motor-cars, 281. constitution, ϵ , γ , and β -phases, 372.
- Cadmium-tin alloys, constitution, 376, 500. crystallization of ingots, 683. grain-size, 376. hardness, 376. single crystals. See *Single crystals*. tensile properties, 376. vapour tension & activity, 377.
- Cadmium-tin-zinc alloys, activity of cadmium & zinc, 377. deposition. See *Deposition*.
- Cadmium-zinc alloys, corrosion. See *Corrosion*. deposition. See *Deposition*. vapour-tension & activity, 377.
- Cæsium-sodium alloys, constitution, 54.
- Calcium-gold alloys, constitution, 506.
- Calcium-lead alloys, age-hardening. See *Age-hardening*. crystal structure, 589. electro-chemical behaviour in storage cells, 528, 703. for storage-cell grids & plates, properties, 507, 676.
- Calcium-lead-sodium alloys, age-hardening. See *Age-hardening*. phases, x-ray study, 11. pounding tests, 12. re-melting. See *Melting*.
- Calcium-magnesium-zinc alloys, constitution, 508. mechanical properties, 508. preparation, 215, 508. properties, 578.
- Calcium-silver alloys, constitution, x-ray study, 378. crystal structure, 589.
- Calcium-thallium alloys, crystal structure, 589.
- Carbides, high melting-point, properties, review, 680.

Alloys & compounds—

- Carboly (see also *Alloys : Super-hard alloys & Tungsten carbide*), pamphlet, 319.
- Caro bronze, tubes for bushes, Brit. Air Min. specification, 735.
- Celsite, metallographic tests, 57.
- Ceralumin C, properties & uses, 213, 671.
- Ceralumin D, die-castings, Brit. Air Min. specifications, 486. sand-castings, Brit. Air Min. specifications, 486.
- Cerium alloys, chem. prepn., 555.
- Cerium-lead alloys, crystal structure, 589.
- Cerium-magnesium alloys, crystal structure of CeMg, 100.
- Cerium-mercury alloys, prepn., 141.
- Cerrobaze, 404.
- Cerrobend, 404.
- Cerromatrix, 404.
- Cerroseal, 404.
- Chromium alloys (see also *Alloys : Alsichrom, Inconel, Kanthal, Megapyr, Nichrome, Permatherm, &c.*), affinity for nitrogen, 570. corrosion. See *Corrosion*. review, 138.
- Chromium-cobalt-carbon alloys, constitution, 570.
- Chromium-cobalt-iron alloys, thermal expansion, 148.
- Chromium-cobalt-tungsten alloys. See *Alloys : Stellite*.
- Chromium-gold alloys, electrical resistance, 9, 86. heat-treatment. See *Heat-treatment*. preparation, 9. thermoelectric power, 9, 584.
- Chromium-iron alloys, bibliography, 570. constitution, 215. in stainless steel production, compn. & impurities, 54. mechanical properties, effect of temp., 570. melting points, 148. non-metallic inclusions, 282, 681.
- Chromium-iron-carbon alloys, mech. properties, effect of temp., 570.
- Chromium-iron-nickel alloys (see also *Alloys : Inconel, Nichrome, &c.*), creep, 93. electrical properties, 571. fatigue limit, improvement, 716. for electrical heating elements, A.S.T.M. specifications, 643; properties, 571. mechanical properties, 571.
- Chromium-iron-nitrogen system, constitution, x-ray study, 343.
- Chromium-iron-silicon alloys, creep, 93. solubility of carbon, 503.
- Chromium-magnesium-zinc alloys, properties, 578.
- Chromium-nickel alloys (see also *Alloys : Inconel, Megapyr, &c.*), analysis. See *Analysis*.

Alloys & compounds—

Chromium-nickel alloys,
 constitution, x-ray study, 100.
 corrosion. See *Corrosion*.
 diffusion of hydrogen, 139.
 effect of furnace atmospheres, 374.
 electrical heating elements, properties, 374, 509.
 electrical properties, 374, 571.
 for electrical heating elements, 509, 678; A.S.T.M. specifications, 642; properties, 571.
 for electrical resistances, 642.
 forging. See *Forging*.
 heat-treatment. See *Heat-treatment*.
 in chemical technology, 187.
 in paper industry, 642.
 mechanical properties, 571; at low temps., 501.
 thermal properties, 374.
 wire-drawing. See *Wire-drawing*.

Chromium-nickel-carbon alloys, constitution, 570.

Chromium-platinum alloys,
 constitution, 509.
 electrical resistance, 509.
 ferromagnetism, 342.
 hardness, 509.

Chromium steels, book, 266.

Cobalt alloys. See also *Alloys: Stellite*, &c.

Cobalt-gold alloys,
 for electrical resistances, 340.
 thermoelectric force from 17.5° to 2.5° K., 584.

Cobalt-iron alloys, non-metallic inclusions, 282, 681.

Cobalt-iron-nickel alloys. See *Alloys: Perminvar*.

Cobalt-iron-nickel-titanium alloys, magnetic properties, 148.

Cobalt-iron-tin alloys, constitution, 418.

Cobalt-iron-titanium alloys, constitution, 418.

Cobalt-magnesium alloys,
 constitution, 374.
 density, 374.
 hardness, 374.
 melting points, 374.
 microstructure, 374.
 preparation, 374.

Cobalt-magnesium-zinc alloys, properties, 578.

Cobalt-manganese alloys, ferromagnetism, relation of lattice parameter, 216.

Cobalt-mercury alloys, decompn., 503.

Cobalt-molybdenum alloys, constitution, 672.

Cobalt-molybdenum-carbon alloys, constitution, 148.

Cobalt-nickel alloys,
 constitution, 464.
 electrical conductivity, 464.
 electrical resistance, temp. coeff., 464.
 hardness, 464.
 magnetic properties, 464.
 thermal expansion, 464.
 thermoelectric force, 464.

Alloys & compounds—

Cobalt-palladium alloys,
 constitution, 584; magnetic study, 214.
Cobalt-phosphorus alloys, crystal structure, 593.

Cobalt-silicon alloys, crystal structure, 592.

Cobalt-tantalum-carbon alloys, constitution, 148, 680.

Cobalt-tin alloys, compounds, 341.

Cobalt-titanium-carbon alloys, constitution, 148.

Cobalt-zinc alloys, compounds, 341.

Constantan,

analysis. See *Analysis*.

corrosion. See *Corrosion*.

fuse wire, melting time, 644.

grain-size, relation to dendrite-fineness, 585.

Copper alloys (see also *Alloys: Bearing alloys, Beryllium-bronzes, Brasses, Bronzes, Constantan, Corrix, Everdur, Gun-metal, Herculoxy, Manganese-brasses, Manganin, Nickel-brasses, P.M.G. metal, &c.*),

age-hardening. See *Age-hardening*.

analysis. See *Analysis*.

annealing. See *Annealing*.

binary, effect of adms., 504; high-grade, search for, 504.

book, 82.

casting. See *Casting*.

colouring. See *Colouring*.

constitution, β -transformation, 282.

corrosion. See *Corrosion*.

cylinder heads, tests, 79.

deoxidation. See *Deoxidation*.

die-casting. See *Die-casting*.

diffusion of zinc, 90.

dye kettles, 738.

electrical conductivity, 571, 676; relation to thermal conductivity, 571.

enamelling. See *Enamelling*.

for food industry, 187.

for sea-water use, 690.

for super-heated steam, 690.

forging. See *Forging*.

foundry practice, effect of melting losses on cost, 623.

hardness, change due to grain-refinement by peritectic reaction, 8.

in architecture, 542; booklet, 648.

in food industries, 734.

in oil refinery, prevention of corrosion by use of ammonia, 697.

limit of proportionality, change due to grain-refinement by peritectic reaction, 8.

melting. See *Melting*.

metallographic etching, 682.

odour, 48.

polishing. See *Polishing*.

statistics, 734.

substitutes, 37.

taste, 48.

tensile properties, change due to grain-refinement by peritectic reaction, 8.

thermal conductivity, 571, 676; relation to elect. conductivity, 571.

welding. See *Welding*.

- Alloys & compounds—**
 Copper-cuprous oxide eutectic, structure & origin, 100.
 Copper-gallium alloys, constitution, 503.
 Copper-gold alloys, constitution, 575; phases of variable compn., 575; transformations, 676. corrosion. See *Corrosion*.
 CuAu, transition of lattice, 338.
 crystal structure, 467; at high temps., 424.
 hardening during transformation, effect of addns., 465.
 mechanical properties, 575.
 solubility in cyanide solutions, 18.
 Copper-indium alloys, constitution, 504.
 Copper-iron alloys, age-hardening. See *Age-hardening*.
 book, 551 (*review*).
 constitution, solid soly. of copper, x-ray study, 149.
 non-metallic inclusions, 282, 681.
 Copper-iron-nickel alloys, constitution, miscibility gap, 504, 505. deposition. See *Deposition*.
 magnetic properties, 9, 580.
 of high initial permeability, 580.
 Copper-iron-tin alloys, properties, 675.
 Copper-iron-zinc alloys, constitution, 506.
 Copper-lead alloys, bearings, effect of lubricants, 487.
 production, elect., 703.
 Copper-lead-nickel alloys, bearings, failure, 10.
 Copper-lead-nickel-zinc alloys, constitution, liquidus points, 151, 674.
 Copper-lead-tin alloys (see also *Alloys: Lead-bronzes*), Roman mirror, chem. & met. study, 574.
 Copper-magnesium alloys, constitution, solid soly. of copper, 677.
 oxidation, 515.
 Copper-magnesium-nickel-zinc alloys, solid solns., 593.
 Copper-magnesium-zinc alloys, properties, 578.
 Copper-manganese alloys, electrical conductivity, 571, 676.
 inverse segregation, 154.
 thermal conductivity, 571, 676.
 volume changes on solidification, 154.
 Copper-manganese-silicon alloys. See *Everdur*.
 Copper-manganese-tin alloys, properties, 675.
 Copper-mercury alloys, crystal structure of CuHg, 467.
 Copper-nickel alloys, corrosion. See *Corrosion*.
 creep, correlated with x-ray line broadness, 16.
 diffusion of hydrogen, 139.
 electrical conductivity, 571, 676.
 elongation values, 27.
 gyromagnetic effect, 660.
 heat-treatable, pamphlet, 128.
 melting. See *Melting*.
- Alloys & compounds—**
 Copper-nickel alloys, optical constants, 420.
 special, mech. properties, 51.
 specific heat, true, 370.
 thermal conductivity, 571, 676.
 working ranges, 484.
 wrought, properties, 338.
 Copper-nickel-silicon alloys, age-hardening. See *Age-hardening*.
 creep, 673.
 Copper-nickel-tin alloys (see also *Alloys: Nickel-bronzes, &c.*), corrosion. See *Corrosion*.
 Copper-nickel-tin-zinc alloys, constitution, liquidus points, 151, 674.
 Copper-nickel-tungsten alloys, for radium beam therapy, 377.
 Copper-nickel-zinc alloys (see also *Alloys: Nickel-brasses*), book, 650.
 constitution, heterogeneous equilibria, 215.
 corrosion. See *Corrosion*.
 deposition. See *Deposition*.
 solid solutions, relation between elect. conductivity & compn., 584.
 Widmanstätten structure, 215.
 Copper-oxygen system, solid soly. of oxygen, 96.
 Copper-palladium alloys, allotropic modification, kinetics & mechanism, 678.
 Copper-platinum alloys, elect. conductivity at low temps., 572.
 Copper-praseodymium alloys, constitution, 98.
 Copper-rhodium alloys, constitution, 217.
 crystal structure, 217.
 Copper-silicon alloys, book, 38.
 constitution, 7, 573.
 corrosion. See *Corrosion*.
 crystal structure of cubic phase, 468.
 ductile, 214.
 electrical conductivity, 571, 676.
 in automobile industry, 127.
 inverse segregation, 154.
 mechanical properties, 573.
 plates, A.S.T.M. specifications, 124.
 rods, bars, & shapes, A.S.T.M. specifications, 124.
 sheets, A.S.T.M. specifications, 124.
 thermal conductivity, 571, 676.
 volume changes on solidification, 154.
 Copper-silicon-tin alloys, properties, 675.
 Copper-silicon-tin-zinc alloys. See *Alloys: Hercules*.
 Copper-silicon-zinc alloys. See *Alloys: Silicon-brasses*.
 Copper-silver alloys, age-hardening. See *Age-hardening*.
 coinage (720), splitting of strip on rolling, 54.
 constitution, x-ray study, 674.
 crystal structure, 594.
 inverse segregation, 154.
 precipitation of silver, detection, 505.
 properties, effect of crystal structure, 511.

Alloys & compounds—

- Copper-silver alloys**,
 refining. See *Refining*.
 solubility in cyanide solutions, 18.
 volatilization through chloride, 502.
 volume changes on solidification, 154.
 Widmanstätten structure, 156, 683.
- Copper-silver-zinc alloys** (see also *Alloys : Solders*),
 solid solutions, relation between elect. conductivity & compn., 584.
- Copper-tin alloys** (see also *Alloys : Bronzes, Gun-metal, &c.*),
 constitution, 12, 96; β -transformations, 282; soly. limits of α -phase, 150, 573; transformation of α -phase after deformation, 573; x-ray studies, 56, 289, 343, 674.
 corrosion. See *Corrosion*.
 deposition. See *Deposition*.
 inverse segregation, 154.
 low-copper, properties, 12.
- Copper-tin-zinc alloys**,
 castings, A.S.T.M. specifications, 125.
 constitution, 574.
 solid solutions, relation between elect. conductivity & compn., 584.
- Copper-zinc alloys** (see also *Alloys : Brasses, &c.*),
 analysis. See *Analysis*.
 constitution, 99; $\alpha \rightarrow \beta$ transformation, 151; β -transformation, 282; effect of nickel on β -transformation, 215.
 corrosion. See *Corrosion*.
 volume changes on solidification, 154.
- Corrix**, 149.
- Cuprite**, corrosion. See *Corrosion*.
- Cuprous oxide**, determination in copper, planimetric, 42.
- D2**, sheets & strips, Brit. Air Min. specification, 733.
- DM 31**, properties, 671.
- Dental alloys** (see also *Alloys : Gold alloys, Mercury alloys, &c.*),
 chemical properties, 679.
 clinical study, 679.
 effect of nickel, 420.
 effect of soldering & other heat-treatment, 506.
 low-cost, 403.
 mercury for, 642.
 review, 79.
 setting, factors affecting, 677.
- Dowmetal**,
 properties, booklet, 407.
 shop practice, booklet, 407.
 specifications, booklet, 407.
- Duralite**, in funicular railway, 732.
- Duralumin**,
 age-hardening. See *Age-hardening*.
 aircraft wing spars, design, 186.
 airscrews, manuf., 186.
 aluminium-coated. See *Duralplat, &c.*
 analysis. See *Analysis*.
 anodic oxidation. See *Anodic oxidation*.
 casting. See *Casting*.
 corrosion. See *Corrosion*.

Alloys & compounds—

- Duralumin**,
 corrosion-fatigue. See *Corrosion-fatigue*.
 creep, abnormal, during transformation, 671.
 crystals, deformed, changes in intensity of x-ray reflection, 425.
 cylinders, thin-walled, of elliptic section, strength tests, 409, 417; thin-walled, strength tests in combined transverse shear & bending, 315, 321.
 development, review, 503.
 effect of heat-treatment, 629.
 effect of impurities, 670.
 elastic modulus, 667.
 endurance strength, 514.
 fatigue, at low temps., 355, 714; effect of pickling, 8.
 fluidity, effect of dust films, 250.
 forging. See *Forging*.
 heat-treatment. See *Heat-treatment*.
 hot-worked, mech. properties, 724.
 in aircraft, 315.
 in automobiles, 639.
 in funicular railway, 732.
 mechanical properties after working, 724; at low temps., 422, 501.
 mine skips & cages, 732.
 painted, accelerated tests, 234.
 painting, tests (33 systems), 234.
 pickling. See *Pickling*.
 plated, corrosion-resistance, effect of heat-treatment, 514.
 pressing. See *Pressing*.
 pressings, properties, 186; residual lattice stress, 56.
 properties, 462.
 protected, corrosion tests, 164.
 protection by chem. deposits, 232.
 recrystallization, difficulties in x-ray analysis, 221, 423; x-ray study, 512.
 riveting. See *Riveting*.
 rivets, heat-treatment furnaces. See *Furnaces*; improvement, 32.
 rods, notch stresses, 462.
 sheet, flexibility, detn., 110; relation of mech. properties to method of cooling during hardening, 116; weathering, 17, 85.
 solid viscosity, 336.
 specific heat, true, 370.
 stamping. See *Stamping*.
 torsion diagrams, 356.
 welding. See *Welding*.
- Duralumin G**, bars, Brit. Air Min. specifications, 733.
- Duralumin 25 S**, effect of low temp., 645.
- Elektron** (see also *Alloys : Magnesium alloys*),
 analysis. See *Analysis*.
 corrosion. See *Corrosion*.
 creep, 508.
 development, 54.
 forging. See *Forging*.
 heat-treatment. See *Heat-treatment*.
 properties, 54.
 protection by fluoride coatings, 600.
 recrystallization, 56.

Alloys & compounds—

- Everdur, properties, 573.
 F.M. alloy, 348.
 Fahrig's antifriction metal, 219.
 Fermet, 219.
 Fernichrome,
 composition, 68.
 envelopes for radio valves, 736.
 Fernico,
 composition, 68.
 envelopes for radio valves, 736.
 in glass-metal joints, 68, 646.
 Ferro alloys,
 analysis. See *Analysis*.
 electrolytic production, 703.
 Ferro aluminium, analysis. See *Analysis*.
 Ferro-chromium. See *Alloys : Chromium-iron alloys*.
 Ferro-molybdenum,
 analysis. See *Analysis*.
 specifications, A.S.T.M., 642.
 Ferro-tungsten,
 analysis. See *Analysis*.
 manufacture, 188.
 specifications, A.S.T.M., 644.
 Ferrul alloy, 219.
 Ferry metal, 219.
 Fletcher's bearing metal, 219.
 Flint metal, 219.
 Fontane's metal, 342.
 Forbe's metal, 342.
 Fourdrinier metal, 219.
 Frary alloy, 342.
 Fricke's nickel-brass, 342.
 Frischmut solder, 342.
 Fusible alloys, appns., 739.
 Gallium-lithium alloys, crystal structure, 589.
 Gallium-potassium alloys, soly. of potassium, 465.
 Gallium-sodium alloys, soly. of sodium, 465.
 Gallium-tin alloys, single crystals. See *Single crystals*.
 Gedge's brass, 342.
 Gemma bearing alloy, 342.
 Genelit, 342.
 German silver. See *Alloys : Nickel-brasses*.
 Germania white bronze, 342.
 Germanium-tellurium alloys, constitution, 506.
 Gilding metal,
 elongation values, 27.
 melting. See *Melting*.
 Giuschi-Buischi, 342.
 Gliavor bearing alloy, 342.
 Gold alloys,
 analysis. See *Analysis*.
 compositions, 97.
 in dentistry, 79.
 properties of some new, 97.
 "white." See *Alloys : White gold*.
 Gold-iron alloys,
 ageing properties, 100.
 constitution, x-ray study, 100.
 magnetic properties, 100.
 thermoelectric force, from 17.5° to 2.5° K., 584.

Alloys & compounds—

- Gold-lead alloys,
 Au, Pb, crystal structure, 15, 222.
 solubility of gold, 52.
 Gold-lithium alloys, crystal structure, 589.
 Gold-manganese alloys, thermoelectric power from 17.5° to 2.5° K., 584.
 Gold-nickel alloys, thermoelectric power from 17.5° to 2.5° K., 584.
 Gold-palladium alloys, hydrogen-saturated, crystal structure, 424.
 Gold-palladium-silver alloys, analysis. See *Analysis*.
 Gold-platinum-silver alloys, analysis. See *Analysis*.
 Gold-praseodymium alloys, constitution, 98.
 Gold-silver alloys,
 crystals, deformed, change in intensity of x-ray reflection, 425.
 electrical resistance, 52.
 magnetic susceptibility, 52.
 single crystals. See *Single crystals*.
 solid solutions, thermodynamic properties, 465.
 solubility in cyanide solutions, 18.
 thermoelectric force from 17.5° to 2.5° K., 584.
 volatilization through chlorides, 502.
 Gun-metal (see also *Alloys : Bronzes* & under names of constituent metals),
 brazing. See *Brazing*.
 effect of lead, 574, 675.
 grain-size, relation to dendrite fineness, 585.
 improvement, effect of phosphor-copper, 716.
 Hafnium carbide, properties, review, 680.
 Herculey, properties, 573.
 Heusler's alloys (see also *Alloys : Aluminium-copper-manganese alloys*),
 magnetic properties, 419.
 magneto-resistance at low & high temps., 137, 198.
 Hiduminium. See also *Alloys : R.R. alloys*.
 Hiduminium 72, bars, Brit. Air Min. specifications, 733.
 Hochheim alloy, reflection coeff. in spectral region 300-186 μ , 564.
 Hydronalium,
 corrosion. See *Corrosion*.
 electrical conductivity, 462.
 mechanical properties, 51.
 use to withstand sea water, 51.
 Hytenzyl bronze, corrosion. See *Corrosion*.
 Inconel,
 corrosion. See *Corrosion*.
 properties, 346.
 Indium alloys, bibliography, 138.
 Indium-lithium alloys,
 constitution, 508.
 crystal structure, 589.
 Indium-silver alloys,
 constitution, 465; x-ray study, 686.

Alloys & compounds—

Indium-sodium alloys, lattice structure, 589.

Invar,

electrical resistance, effect of direction of spontaneous magnetization, 211.
wires, changes in length, 421.

Iron alloys,

corrosion. See *Corrosion*.
for electrical industry, 404.
non-metallic inclusions, 282, 681.
patents, book, 407.

Iron-carbon-manganese alloys, constitution, 151, 578.

Iron-carbon-manganese-silicon alloys, constitution, review, 54.

Iron-carbon-molybdenum alloys, metallographic etching, 682.

Iron-carbon-tungsten alloys, metallographic etching, 682.

Iron compounds, chemistry, book, 136 (review).

Iron-manganese alloys (see also *Alloys : Ferro-manganese*),

bibliography, 578.
constitution, 215, 578; review, 54;
transformations, 508.
in steel industry, book, 83.
non-metallic inclusions, 282, 681.
solubility of carbon, 9.

Iron-manganese-silicon alloys,

constitution, review, 54.
solubility of carbon, 9.

Iron-molybdenum alloys (see also *Alloys : Ferro-molybdenum*),

absorption of hydrogen, 151.
absorption of nitrogen, 151.
age-hardening. See *Age-hardening*.
coercive force, effect of ageing, 152.
crystal structure of intermediate phase, 512.
electrical resistance, effect of ageing, 152.
magnetic induction, effect of ageing, 152.

non-metallic inclusions, 282, 681.

Iron-molybdenum-nickel alloys, constitution, 152.

Iron-neodymium alloys, magnetic properties, 215.

Iron-nickel alloys, (see also *Alloys : Isoperm, Permalloy, &c.*),

Barkhausen effect, propagation, 581.
constitution, 512.
corrosion. See *Corrosion*.
crystal lattice distortion, 687.
deposition. See *Deposition*.
elastic modulus, effect of magnetization, 565, 678.

electrical resistance, changes with magnitude of a.c., magnetic field, & reactance, 678; effect of direction of spontaneous magnetization, 211.
electrodeposited, crystal structure, 512.
fuse wire, melting time, 644.

heat-treatment. See *Heat-treatment*.
magnetic properties, effect of cold-rolling & heat-treatment, 152; effect of pptn.-hardening, 421; relation of rolling & recrystn. textures, 588.

Alloys & compounds—

Iron-nickel alloys,

non-metallic inclusions, 282, 681.
pupin cores, magnetic properties, 580.

recrystallization texture, 588; relation to magnetic properties, 588.

rolling texture, 588; relation to magnetic properties, 588.

wear, 421.

wires, skin effect, 678.

Iron-nickel-vanadium alloys, constitution, 509.

Iron-phosphorus alloys,

constitution, 215.
crystal structure, 593.

Iron-platinum alloys,

constitution, 581.
magnetic properties, 581.

Iron-silicon alloys,

constitution, 215.
non-metallic inclusions, 282, 681.
single crystals. See *Single crystals*.

Iron-tantalum alloys, constitution, 464, 680.

Iron-tin alloys, properties, 12.

Iron-titanium alloys, constitution, 466.

Iron-tungsten alloys,

book, 38.
crystal structure of intermediate phase, 512.

in stainless steel production, compn. & impurities, 54.

non-metallic inclusions, 282, 681.

Iron-vanadium alloys, non-metallic inclusions, 282, 681.

Iron-zinc alloys, constitution, 582.

Iso-Elastic, 284.

Isoperm, development, 152.

J-metal. See *Alloys : Stellite*.

J.B. 38 A, sheet, Brit. Air Min. specifications, 735.

K.S. (magnet alloy), 148.

K. S. Seewasser, corrosion. See *Corrosion*.

Kanthal,

electrical resistances, properties, 377.
melting point, 148.
properties, 579.

Kanthal-A, elect. resistance elements, tests, 375.

Konel, torsional modulus at elevated temps., 10.

Lanthanum-lead alloys, crystal structure of LaPb, 289.

Lanthanum-magnesium alloys, crystal structure of LaMg, 100.

Lanthanum-mercury alloys, elect. prodn., 97, 141.

Lanthanum-thallium alloys, crystal structure of LaTl, 157.

Lanthanum-tin alloys, crystal structure of LaSn, 289.

Lautal,

age-hardening. See *Age-hardening*.

corrosion. See *Corrosion*.

effect of impurities, 670.

tensile properties, 50.

tubes, hydraulic tests, 163; tensile properties, 153.

Alloys & compounds—

Lead alloys (see also *Alloys : Babbitt metals, Bearing alloys, Solders, &c.*), age-hardening. See *Age-hardening*. analysis. See *Analysis*.

anodes, stability in elect. prodn. of zinc, 450.

bearing, hardened with alkali & alkaline earth metals, properties, 52; hardening, 507; indentation tests, effect of flow, ageing, & prolonged heating, 11; pounding tests, 12; properties, 36, 282, 676; tensile tests, 11; uses, 36; with high copper content, 215.

cable-sheath, comparison, 507; corrosion. See *Corrosion*; defects, 658; longitudinal cracks, 658.

corrosion. See *Corrosion*.

creep fracture, 273.

for cables, tensile & bending tests, 340. for storage cell grids & plates, 507, 528, 703.

melting. See *Melting*.

metallography, prepn. of specimens, 156, 342.

powders, prodn., 723.

properties, review of literature, 498.

surface tension under oxidizing conditions, 340.

Lead-brasses, 574.

Lead-bronzes,

bars for bearings, Brit. Air Min. specifications, 734.

casting. See *Casting*.

effect of manganese, 505.

in Naval machinery, 37.

ingots for bearings, Brit. Air Min. specification, 734.

porosity of bushings, 624.

precipitation of lead, prevention, 535.

preparation, review, 464.

properties, review, 464.

review, 574.

Lead compounds, thermodynamic data, 241.

Lead-lithium alloys, constitution, 53.

Lead-magnesium-tin alloys, corrosion. See *Corrosion*.

Lead-magnesium-zinc alloys, properties, 578.

Lead-manganese-nickel bronze, for bearings, advantages, 505.

Lead-mercury alloys,

constitution, soly. of lead, 464.

free energy of formation, 374.

Lead-praseodymium alloys, crystal structure of PrPb_3 , 101.

Lead-strontium alloys, crystal structure, 589.

Lead-tantalum alloys, superconductive, penetration of magnetic field, 585.

Lead-tellurium alloys, cable-sheath, 507.

Lead-thallium alloys,

constitution, review, 153.

specific heat of PbTl_2 , 508.

superconductive, elect. resistance, detection, 576; penetration by magnetic field, 219, 576.

superconductivity of PbTl_2 , 422, 676, 681.

Alloys & compounds—

Lead-tin alloys,

analysis. See *Analysis*.

solders. See *Alloys : Solders*.

Lead-tin-zinc alloys, activity of zinc, 377.

Lead-zinc alloys,

constitution, 98.

vapour tension & activity, 377.

Lithium-ammonia system,

electrical conductivity, 414.

galvanomagnetic effects, 414.

Lithium-magnesium alloys, constitution, 98, 576, 577.

Lithium-mercury alloys,

constitution, 508.

crystal structure, 589.

Lithium-silver alloys, crystal structure, 589.

Lithium-thallium alloys, crystal structure, 589.

Lithium-tin alloys,

constitution, 53.

crystal structure, 589.

Lithium-zinc alloys,

constitution, 576.

crystal structure, 589.

Magnalium,

pressings, properties, 186.

reflectivity in ultra-violet, 68.

welding. See *Welding*.

Magnesium alloys (see also *Alloys : Dowmetal, Elektron, &c.*),

atomic properties, 213.

bibliographies, 1, 98.

casting. See *Casting*.

castings, Brit. Air Min. specification, 736; for lightly stressed parts, Brit. Air Min. specification, 736;

for pressure work, Brit. Air Min. specification, 736; industry in 1934, 543.

cold-working properties, 341.

compositions, 1.

constitution, review, 98.

corrosion. See *Corrosion*.

development, review, 642.

die-casting. See *Die-casting*.

die-castings, A.S.T.M. specifications, 125.

effect of metallic impurities, review, 589.

extrusion. See *Extrusion*.

forging. See *Forging*.

forgings, A.S.T.M. specifications, 125.

foundry characteristics, 1.

heat-treatment. See *Heat-treatment*.

high-strength, 582.

history, 731.

hot-working properties, 341.

identification, by chem. methods, 106.

in aircraft, 403.

in automobile industry, 127.

in service, requirements, 1.

ingots for remelting, A.S.T.M. specifications, 125.

lattice constitution, 213.

mechanical properties, 1.

melting. See *Melting*.

painting. See *Painting*.

physical properties, 1.

Alloys & compounds—

- Magnesium alloys,
 - physico-chemical properties, review, 98.
 - plating on. See *Deposition*.
 - properties, compared with those of other structural materials, 128.
 - protection, 227, 695; by fluoride coatings, 600.
 - protective films on, electron diffraction study, 683.
 - sand-castings, A.S.T.M. specifications, 125.
 - service characteristics, 1.
 - sheet, A.S.T.M. specifications, 125.
 - surface protection, 1.
 - ternary, research, 578.
 - trade designations, 1.
 - uses, 34, 731; in German industry, 541; see also entries above.
 - welding. See *Welding*.
 - wrought, mech. properties, 373.
- Magnesium-manganese alloys,
 - constitution, 577, 677.
 - oxidation, 515.
- Magnesium-manganese-zinc alloys,
 - oxidation, 515.
 - properties, 578.
- Magnesium-mercury-zinc alloys, properties, 578.
- Magnesium-nickel alloys,
 - crystal structure, 513; of $MgNi_2$, 513, 593.
- Magnesium-nickel-zinc alloys, properties, 578.
- Magnesium-silicon-zinc alloys,
 - constitution, 374, 549, 578.
 - properties, 578.
- Magnesium-silver-zinc alloys, properties, 578.
- Magnesium-tellurium-zinc alloys, properties, 578.
- Magnesium-thallium alloys, crystal structure, 589.
- Magnesium-thallium-zinc alloys, properties, 578.
- Magnesium-tin-zinc alloys,
 - constitution, 340.
 - corrosion. See *Corrosion*.
 - properties, 578.
- Magnesium-zinc alloys,
 - corrosion. See *Corrosion*.
 - $MgZn_2$, crystal structure, 222; sp. heat at higher temps., 561.
 - solid solutions, supersatd., decompn., 8.
 - specific heat at higher temps., 561; true, 370.
 - wrought, mech. properties, 373.
- Mallory 3, 463.
- Mangal, roofing, 123.
- Manganese alloys (see also *Alloys*: *Manganin*, &c.),
 - book, 82.
 - in steel industry, book, 83.
- Manganese-brasses,
 - casting. See *Casting*.
 - effect of lead, 574.
 - mechanical properties, 582.
 - melting. See *Melting*.
 - metallurgical features, 97.
 - specifications, U.S. Navy, 641.

Alloys & compounds—

- Manganese—"bronze." See *Alloys*: *Manganese-brasses*.
- Manganese-carbon alloys, constitution, review, 54.
- Manganese-nickel alloys,
 - constitution, 421.
 - fuse wire, melting time, 644.
- Manganese-palladium alloys, constitution, 584, 679.
- Manganese-phosphorus alloys, crystal structure, 593.
- Manganese-silicon alloys,
 - constitution, 344; review, 54.
- Manganese-tin alloys,
 - compounds, 341.
 - preparation, 375.
 - properties, 375.
- Manganese zinc alloys, compounds, 341.
- Manganin,
 - aluminium-, properties, 419.
 - compressibility, 416.
 - "double," mech. properties, 419.
 - electro-physical properties, reproducibility, 150.
 - resistance wire, stability, effect of design, 572.
- Megapyr,
 - electrical resistances, properties, 377.
 - melting point, 148.
- Mercury alloys,
 - atomic properties, 213.
 - in dentistry, 79.
 - lattice constitution, 213.
 - vapour pressure, abnormalities, 374.
 - viscosity, 498.
- Mercury-neodymium alloys, prepn., 141.
- Mercury-potassium alloys,
 - electrode potentials, 703.
 - vapour pressures, 374.
- Mercury-rubidium alloys, constitution, 508.
- Mercury-samarium alloys, prepn., 141.
- Mercury-silver alloys,
 - chemical properties, 341.
 - crystal structure of Ag_3Hg_4 , 379.
 - density, 678.
 - electrical resistance, 678.
 - electrode potentials, 678.
 - electrosynthesis, 341.
 - hardness, 678.
 - liquid, transport number & valency of silver, 581.
 - preparation, 677.
- Mercury-sodium alloys,
 - are they colloidal?, 152, 283.
 - catalytic decomposition, 217.
 - electrode potentials, 703.
 - surface tension, 464.
 - vapour pressures, 374.
- Mercury-thallium alloys,
 - constitution, 218.
 - crystal structure, 218.
 - electrochemical study, 218.
 - parachor of thallium, 98.
 - surface tension, 464.
- Mercury-tin alloys,
 - chemical properties, 341.
 - density, 678.
 - electrical resistance, 678.

Alloys & compounds—

- Mercury-tin alloys**,
 electrode potentials, 678.
 electrosynthesis, 341.
 hardness, 678.
 preparation, 677.
 reflectivity in ultra-violet, 68.
Mercury-yttrium alloys, prepn., 141.
Mercury-zinc alloys,
 chemical properties, 341.
 density, 678.
 electrical resistance, 678.
 electrode potentials, 678.
 electrosynthesis, 341.
 hardness, 678.
 preparation, 677.
 vapour pressures, 374.
Molybdenum-carbon alloys,
 constitution, 579, 678.
 properties, review, 680.
Molybdenum-nickel alloys, ferromagnetism, relation of lattice parameter, 216.
Molybdenum-nickel-carbon alloys, constitution, 683.
Molybdenum-tungsten alloys,
 electron emission, 681.
 spectral emissivities, 377.
Monel metal,
 aluminium—, mech. properties, 341.
 bolts, impact & static tensile properties, 339.
 book, 81.
 brazing. See *Brazing*.
 corrosion. See *Corrosion*.
 drilling. See *Drilling*.
 dye kettles, 738.
 electrodes for welding pig iron, 638.
 finishing, 484.
 fuse wire, melting time, 644.
 grinding. See *Grinding*.
 in aircraft, 263.
 in bottling industry, 375.
 in brewery, 375.
 in building, 126.
 in canning equipment, 102.
 in chemical plant, 645.
 in petroleum industry, 643.
 machining. See *Machining*.
 physical properties, 216.
 polishing. See *Polishing*.
 soldering. See *Soldering*.
 sprayed coatings, tests in alkaline liquors, 602.
 spraying. See *Spraying*.
 stamping. See *Stamping*.
 valve seats, wear, 126.
 welding. See *Welding*.
 wire fabrics, uses, 645.
Monel metal "K," 421, 465.
Mumetal wires, skin effect, 678.
Muntz metal. See *Alloys : Brasses & under names of constituent metals*.
N.A. 4 S, sheet & strip, Brit. Air Min. specification, 733.
N.A. 24 S, bars, Brit. Air Min. specifications, 733.
Neusilber, soldering. See *Soldering*.
Nichrome wire, manuf., 446, 725.

Alloys & compounds—

- Nickel alloys** (see also *Alloys : Constantan, Inconel, Kanthal, Konel, Monel metal, Mumetal, Nichrome, Nickel-brasses, No. 1040, Permalloy, Perminvar, &c.*, & under names of constituent metals),
 analysis. See *Analysis*.
 corrosion. See *Corrosion*.
 for electrical appliances, 643, 648.
 grinding. See *Grinding*.
 heat-treatable, pamphlet, 128; properties, 215.
 high-strength, 582.
 in aircraft, 263.
 in caustic processing equipment, 450.
 in crude oil refining, 451.
 in dairy, 645.
 in food industries, 736.
 in paper making, 451, 542.
 in petroleum industry, 643.
 odour, 48.
 of high initial permeability, 98.
 polishing. See *Polishing*.
 production at works of H. Wiggin & Co., 488.
 rivets, Brit. Air Min. specification, 736.
 rods, Brit. Air Min. specification, 736.
 sheets & strip, Brit. Air Min. specification, 487, 488.
 split pins, Brit. Air Min. specification, 736.
 taste, 48.
 tubes, Brit. Air Min. specification, 736.
 uses, 316; see also entries above.
 valve seats, wear, 126.
 welding. See *Welding*.
 wires, Brit. Air Min. specification, 736.
 works of H. Wiggin & Co., Ltd., 740.
Nickel-brasses (see also *Alloys : Copper-nickel-zinc alloys, &c.*),
 analysis. See *Analysis*.
 annealing. See *Annealing*.
 castability, 151, 674.
 casting. See *Casting*.
 castings, effect of deoxidation procedure on soundness, 151, 674; hardness, 151, 674.
 colour, 151, 674.
 corrosion. See *Corrosion*.
 deoxidation. See *Deoxidation*.
 effect of additions, 676.
 effect of lead, 151, 674.
 fracture, 151, 674.
 heat-treatable, pamphlet, 128.
 hydraulic tests, 151, 674.
 melting. See *Melting*.
 properties, 676.
 shrinkage, 151, 674.
 special, 574.
 tarnishing, 151, 674.
 tensile properties, 151, 674.
 trade names & compns., 441.
 uses, 676.
Nickel-bronzes,
 ageing characteristics, 97.
 in automobile industry, 734.
Nickel-cast iron, booklet, 491.

Alloys & compounds—

Nickel-phosphor-bronzes, analysis. See *Analysis*.
gears, wear tests, 735.

"Nickel silver." See *Alloys : Nickel-brasses*.

Nickel-tantalum-carbon alloys, constitution, 680, 683.
cutting properties, 680.

Nickel-tin alloys, constitution, 12; soly. of tin, 283.
hardening, 283.
properties, 12.

Nickel-titanium-carbon alloys, constitution, 683.

Nickel-tungsten carbon alloys, constitution, 683.

Nickel-zinc alloys, compounds, 341.
constitution, 216, 283.

Nickelin, analysis. See *Analysis*.

Nimol, corrosion. See *Corrosion*.

Niobium alloys, production, 647.
uses, 199.

Niobium carbide, properties, review, 680.

Ni-Resist, corrosion. See *Corrosion*.
No. 1040, 98.

Nüral, 147.

Osmiridium, crystal structure, 223.

Ounce metal, castings, A.S.T.M. specifications, 125.

P.M.G. metal, properties, 573.

Palladium alloys, annealing. See *Annealing*.
properties, 643.
uses, 456.

Palladium-hydrogen alloys, 499, 660.

Palladium-silver alloys, dental plates, 187.
for dental purposes, 679.
hydrogen-saturated, glow electric effect, 283.

Palladium-silver-hydrogen alloys, electrical resistance, 581.
lattice constants, 581.

Palladium-sulphur alloys, constitution, 509.

Pantal, corrosion. See *Corrosion*.

Peraluman, forging. See *Forging*.
pressing. See *Pressing*.

Permalloy,

heat-treatment. See *Heat-treatment*.
magnetic hysteresis, effect of tension, 375.

magnetic permeability, effect of heat-treatment in magnetic field, 629.

magnetization, intensity, effect of a.c., 465.

super-, effect of stress on magnetic properties, 342.

Permatherm, melting point, 148.

Perminvar,

heat-treatment. See *Heat-treatment*.
magnetic permeability, 68; effect of heat-treatment in magnetic field, 629.

Pewter,

buffing. See *Buffing*.

Alloys & compounds—

Pewter,

casting. See *Casting*.
corrosion. See *Corrosion*.
history, 178; book, 88.
melting. See *Melting*.
production, 625.
properties, 178, 625.
rolling. See *Rolling*.
spinning. See *Spinning*.

Phosphor-bronzes,

casting. See *Casting*.
corrosion. See *Corrosion*.
effect of lead, 574.
founding, 307.

heat-treatment. See *Heat-treatment*.

melting. See *Melting*.

nickel. See *Alloys : Nickel-phosphor-bronzes*.

sprayed coatings, tests in alkaline liquors, 602.

tubes, for bushes, Brit. Air Min. specification, 735.

Phosphorus-platinum alloys, 510.

Phosphorus-rhenium alloys, constitution, 510.

Phosphorus-zinc alloys, crystal structure, 594.

Platinum alloys,

analysis. See *Analysis*.
annealing. See *Annealing*.
dies, 451.

Platinum-helium compound, 274.

Platinum-rhodium alloys, constitution, 217.
gauze, corrosion-resistance, 510.
oxidation-resistance, 217.
physical properties, pamphlet, 81.

Platnam, mech. properties, 51.

Plumber's metal, 450.

Plumrite, corrosion. See *Corrosion*.

Pobedit (see also *Alloys : Super-hard alloys*),

bits, compared with Vokar, 737.

contacts, 737.

durability, 582.

welding. See *Welding*.

Potassium-rubidium alloys, constitution, 283.

Potassium-sodium alloys,

liquid, cleaning, 218; magneto-resistance, 218, 283.

Potassium-thallium alloys, crystal structure, 589.

Praseodymium-tin alloys, crystal structure of PrSn_3 , 101.

Precious metal alloys,

effect of nickel, 420.

manufacture, advances, 152.

refining. See *Refining*.

tests, standardization, 713.

R.R. alloys,

castings, effect of feeding on properties, 281.

effect of heat-treatment, 51.

R.R. 50, thermal conductivity, 462.

R.R. 53, thermal conductivity, 462.

R.R. 53 B,

die-castings, Brit. Air Min. specifications, 486.

Alloys & compounds—

R.R. 53 B.

physical properties, 34.

sand-castings, Brit. Air Min. specifications, 486.

R.R. 56 NS, forgings, Brit. Air Min. specifications, 487.

Reinite, metallographic tests, 57.

SSZ alloys, properties, 573.

Satco metal,

behaviour at high speeds, 52.

composition, 641.

in railway work, 9, 642.

properties, 676.

structure, 641.

uses, 641.

Silicon alloys, uses, 10.

Silicon-brasses,

melting. See *Melting*.refining. See *Refining*.

sheets, Brit. Air Min. specifications, 735.

Silicon-bronzes (see also *Alloys: Her-culoy*),corrosion. See *Corrosion*.

for shaped castings, 573.

melting. See *Melting*.

preparation, 573.

properties, 573.

refining. See *Refining*.Silumin (Alpax) (see also *Aluminium-silicon alloys*),

action of boiling acids, 17.

action of boiling linseed oil, 17.

casting. See *Casting*.

castings, properties, 250.

corrosion. See *Corrosion*.

effect of impurities, 670.

electrolytic production, direct, 239, 703.

endurance strength of castings, 95.

in gas industry, 78.

melting. See *Melting*.

modification, theory, 220, 371.

pressings, properties, 186.

sheet, mech. properties, 671; use in aircraft industry, 671.

solubility of sodium, 462.

thermal conductivity, 462.

welds, impact strength, 77.

Silumin-Alpha (Alpax- α), age-hardening. See *Age-hardening*.Silumin-Beta (Alpax- β)

castings, Brit. Air Min. specifications, 487.

mechanical properties, 96.

Silumin-Gamma (Alpax- γ).

castings, Brit. Air Min. specifications, 487.

mechanical properties, 96.

properties, 8.

uses, 8.

Silver alloys,

analysis. See *Analysis*.

coinage blanks, prodn., 723.

for dental purposes, chem. & clinical study, 679.

odour, 48.

refining. See *Refining*.sampling of coinage. See *Analysis*.

solid solutions, effect of addns. on lattice parameters, 424.

Alloys & compounds—

Silver alloys,

tarnishing, 739.

taste, 48.

Silver-sodium alloys, crystal structure, 589.

Silver-tin alloys,

constitution, 12.

properties, 12.

Silver-zinc alloys,

constitution, 679.

thermal conductivity, effect of cold work, 277.

Silzin-bronze, mech. properties, 573.

Sodium-tungsten "bronzes," crystal lattice, 687.

Solders (see also under names of constituent metals),

bibliography, 539.

brazing, penetration of steels, 726.

constitution, 539.

corrosion. See *Corrosion*.

effect of impurities, 75.

for aluminium, 727.

German, economy of tin, 312.

Kookaburra, 635.

low melting point, development, 727.

melting points, 184.

penetration into steels, 397, 726.

properties, 539.

Redifal, 727.

silver, compn., 727; effect of addns., 727; prodn. & appn., 727; properties, 362.

used in U.S. Navy, 184.

uses, 539.

Sormite,

durability, 582.

metallographic tests, 57.

Spartan, durability, 582.

Stalinit, durability, 582.

Steels,

bibliography, 268.

book, 406.

brazing. See *Brazing*.cementation. See *Cementation*.

"cladding," 697.

compressibility, 416.

copper-plated, appns., 700.

corrosion. See *Corrosion*.

creep, abnormal, during transformation, 671; correlated with x-ray line broadness, 16.

effect of ozone, 19.

galvanized. See *Galvanized iron & steel*.galvanizing. See *Galvanizing*.

grain-growth during recrystn., 587, 684.

heat-treatment. See *Heat-treatment*.

heterogeneity, 490, 584.

inclusions, bibliography, 268.

mechanical properties at low temps., 501.

patents, book, 407.

penetration of white metal, 510, 681.

penetration by solders, 397, 726.

photoelectric thresholds in turned state, 93.

physical chemistry, book, 267.

Piobert effect, 665.

Alloys & compounds—

Steels,

protection. See *Calorizing, Deposition, Galvanizing, &c.*

protective films on, comparison of effectiveness, 697.

recrystallization, 587.

solubility in molten zinc, 92.

stainless, book, 322; brazing. See *Brazing*; in rayon & silk industries, 643; mech. properties at low temps., 501.

stressed, penetration of molten white metal, 510, 681.

structures, control of distortion & residual stress, 540.

torsional moduli at elevated temps., 10.

tubes, joints, 37.

welding. See *Welding*.

wire, Cd & Cd-Zn coated, examination, 520.

wire fabrics, uses, 645.

working, book, 265.

Stellite,

analysis. See *Analysis*.

-clad steel, 697.

durability, 582.

valve seats, wear, 126.

Strontium-thallium alloys, crystal structure, 589.

Studite,

durability, 582.

metallographic tests, 57.

Super-hard alloys (see also *Alloys: Tantalum carbide, Tungsten carbide, Carboloy, Pobedit, Sormite, Studite, Vokar, Widia, &c.*),

brazing. See *Brazing*.

cutting tools, cutting speeds, 32.

durability, 582.

manufacture, book, 549.

metallographic etching, 682.

metallography, 470.

patents, 317.

review, 544.

sintered, micro-examination, 683.

welding. See *Welding*.

Supernickel,

fabrication, 399.

properties, 399.

uses, 399.

welding. See *Welding*.

Tantalum carbide (see also *Alloys: Super-hard alloys, &c.*),

impact abrasion hardness, 510, 681.

manufacture, 680.

properties, review, 680.

radiation coefficients, 680.

Tellurium alloys, electron properties, 141.

Thalassal, 76.

Thorium carbide, properties, review, 680.

Tin alloys (see also *Alloys: Babbitt metals, Bearing alloys, Pewter, Solders, White metals, &c.*),

atomic properties, 213.

bearing, failure in railway axles, 12; indentation tests, effect of flow, ageing, & prolonged heating, 11; tensile tests, 11.

Alloys & compounds—

Tin alloys,

binary, constitution, bibliography, 466, 547; equil. diagr., compilation (67 systems), 466, 547.

deposition. See *Deposition*.

lattice constitution, 213.

removal of sulphur, 441.

Tin-zinc alloys, vapour tension & activity, 377.

Titanium alloys, 264.

Titanium carbide,

production, 680.

properties, review, 680.

Titanium nitride, composition, 709.

Tombak, soldering. See *Soldering*.

Tungsten alloys,

in teluradium therapy, 737.

radium-containers, 644.

uses, 188.

Tungsten carbide (see also *Alloys: Carboloy, Super-hard alloys, Widia, &c.*),

cutting tools, prodn. from powdered metals, 544.

impact abrasion hardness, 510, 681.

manufacture, 188; by hot-pressing, 725.

microstructure, 682.

properties, review, 680.

Tungum,

painting. See *Painting*.

properties, 573, 676.

tubes, Brit. Air Min. specifications, 487.

uses, 676.

Type metals (see also under names of constituent metals),

ashes, treatment, 626.

corrosion. See *Corrosion*.

melting. See *Melting*.

production, 97.

properties, 373.

requirements, 97.

structure, 373.

surface tension, under oxidizing conditions, 340.

Vanadium carbide, properties, review, 680.

Vokar,

bits, compared with Pobedit, 737.

durability, 582.

welding. See *Welding*.

welds, micro-examination, 682.

Webbite, effect on aluminium alloys, 126.

Webert alloy, 30.

White gold, distinction from base metal alloys, 352.

White metals (see also *Alloys: Babbitt metals, Bearing alloys, & under names of constituent metals*),

bearing, behaviour when subjected to deformation tests, 11; Brit. Air Min. specification, 488; casting. See *Casting*; cracking, 10, 12, 36; for severe service, improvement, 10, 12; importance of physical structure, 582; indentation tests, effect of flow, ageing, & prolonged heating, 11; pounding tests, 12; tensile tests, 11.

Alloys & compounds—**White metals,**

- borings, sepn. from brass, 179.
- casting. See *Casting*.
- for socketing winding ropes, tests, 188.
- in Naval machinery, 37.
- melting. See *Melting*.
- penetration into steels, 510, 681.
- rolls, manuf., principles involved, 538.

Widia (see also *Alloys: Super-hard alloys, Tungsten carbide, &c.*),
analysis. See *Analysis*.
durability, 582.

Y-alloy,

- age-hardening. See *Age-hardening*.
- effect of heat-treatment, 51.
- effect of impurities, 670.
- mechanical properties, effect of compn., 371.

Zinc alloys,

- analysis. See *Analysis*.
- atomic properties, 213.
- binary, fracture on deformation, 466.
- castings, effect of quality of zinc, 152.
- chromium plating. See *Deposition*.
- copper-plating. See *Deposition*.
- corrosion. See *Corrosion*.
- crystal orientations developed by progressive cold-rolling, 101.
- deep-drawing properties, 118.
- die-casting. See *Die-casting*.
- die-castings, A.S.T.M. specifications, 126; effect of quality of zinc, 153; finishing, 547, 607; impact strength, 111; plating on. See *Deposition*; properties, 681; tensile properties, 422.
- for die-casting, 178; dimensional changes, 54; relation of eutectoidal decompn. to dimensional changes, 13, 681.
- high-strength, 582.
- in gas services, 738.
- in water services, 738.
- lattice constitution, 213.
- mechanical properties, comparative tests, 152.
- nickel-plating. See *Deposition*.
- sheets, effect of quality of zinc, 152; plated with aluminium, properties & uses, 126.
- uses, 188.
- welding. See *Welding*.

Zinc-bronzes,

- casting. See *Casting*.
- deoxidation. See *Deoxidation*.
- melting. See *Melting*.

Zinc oxide, prepn., book, 489.

Zirconium carbide, properties, review, 680.

Aloyalum, 234.

Alpax. See *Alloys*.

Alsichrom. See *Alloys*.

Altmag. See *Alloys*.

Aludur. See *Alloys*.

Alufont. See *Alloys*.

Alumag. See *Alloys*.

Aluman. See *Alloys*.

Alumetizing, 386, 700.

Alumilite process. See *Anodic oxidation*.

Alumina. See *Alloys & compounds, & also Refractory materials*.

Aluminium,

- action of nitrogen, 209.
- action on yeast, 314.
- Alarcar treatment, 312.
- alumina in, investigation, 220.
- analysis. See *Analysis*.
- annealing. See *Annealing*.
- anodic film, inactive state due to formation, 695.
- anodic oxidation. See *Anodic oxidation*.
- awnings, 314.
- bars, thick, bending, 311.
- beer pipes, 486.
- bleaching apparatus, 34.
- books, 81, 82, 266.
- burning, light from, 655.
- cables, breaking length, 186; clamp for, 402; hollow-core, 640; lead-covered, loading tables, 541; review, 541; steel-cored. See *Aluminium, steel-cored cables*.
- casting. See *Casting*.
- castings, effect of purity on plasticity & mosaic structure, 56; porosity, 70; prevention of unsoundness, 393.
- cementation of metals by, 165.
- chemical thermodynamics, book, 407.
- chemistry, book, 132 (*review*).
- chromium-plating. See *Deposition*.
- cleaning. See *Cleaning*.
- coatings, diffusion of copper from copper-aluminium alloys, 146; hot-dipped, on iron, 520, 695; processes, 231.
- cold-work, effect, method of study, 142; recovery from, review, 142.
- colouring. See *Colouring*.
- compressibility, 416.
- conductors, insulated, review, 541.
- containers, formaldehyde in, 449.
- contamination of foods, 543.
- cooking utensils, hygienic significance, 34.
- cooling by air, 2.
- copper-plating. See *Deposition*.
- corrosion. See *Corrosion*.
- corrosion-fatigue. See *Corrosion-fatigue*.
- creep, 335; limit, 96.
- crystal-growth, 511.
- crystallization, 511.
- data sheets, 545.
- deformation texture, 224.
- deformed, changes in properties during recovery, 197.
- deposition. See *Deposition*.
- detection. See *Analysis*.
- die-casting. See *Die-casting*.
- die-castings, appns. in telephone industry, 625; finishing, 119, 634.
- diffusion into iron, 64, 104; into iron, at low temps., 280.
- diffusion of hydrogen, 197, 553.
- distilled, 497.
- distinction from alloys, 345.
- drawing of sheet. See *Drawing*.
- drilling. See *Drilling*.
- dross, &c., utilization, 608.

- Aluminium,**
 dye kettles, 738.
 dynamic rupturing tests, 715.
 effect of heat-treatment, method of study, 142.
 elasticity, Young's modulus, of rods composed of large crystal grains, 333.
 electrical conductivity (of pure), 1.
 electrical resistance at low temps., 413.
 electrodeposits, crystallization, 220.
 electron diffraction patterns, 591.
 entropy, 564.
 estimation. See *Analysis*.
 extrusion. See *Extrusion*.
 fatigue & crystal recovery, 56.
 films, evaporated, for astronomical mirrors, 186; evaporated, photo-elect. effect, 554; reflectivity, 48; scattering of light, 336.
 films on, in acids, optical study, 655.
 fire-resistance, 640.
 foil, effect on keeping quality of butter, 542; emissivity coeff., effect of surface condition, 41; insulating properties, 41, 79, 640; insulation in elect. industry, 402; pipe covering for high temps., 402; thermal conductivity, 542; uses, 35; wrapping of apples in, 185.
 forging. See *Forging*.
 foundry, 534; organization of stores, 488.
 foundry practice, 622.
 furniture, 315.
 gas appliances, 599.
 gases in, 197; removal, 704.
 gold-plating. See *Deposition*.
 grain-growth during recrystn., 587, 684.
 grinding. See *Grinding*.
 handbook, 491.
 hardness (of pure), 1.
 heat of relaxation, from recrystn. data, 563.
 history, 731, 732.
 in architecture, 34, 123, 126, 402, 486, 542; booklet, 545.
 in bleaching apparatus, 17.
 in boats, 124.
 in brewery, 738.
 in cheese industry, 731.
 in chemical industries, 645; books, 412 (review), 545.
 in dairy, 645.
 in dyeing industry, 314.
 in electric motors, 78.
 in electrical apparatus, 402.
 in electrotechnics, 34.
 in food industries, 731; book, 545.
 in gas industry, 78, 401.
 in medical apparatus, 402.
 in military bridges, 542.
 in photography, See *Foto* process, 639.
 in railway work, 34, 262.
 in sewage disposal plants, 541.
 in shipbuilding, 79, 640.
 in sugar mills, 35.
 in telephone industry, 625.
 in textile industry, 79, 314.
 in therapeutic x-ray work, 124.
 in tramway accessories, 78.
 in transport, 185, 449, 732.
- Aluminium,**
 industry, Canadian, 646; in 1935, 127; Japanese, 80, 318; progress, 541.
 ingots, composition, 1; temp. measurement, 306, 619.
 insulating properties. See *Aluminium, foil*.
 lacquering. See *Lacquering*.
 lightning conductors, 186.
 machining. See *Machining*.
 magnetic susceptibility, 51.
 melting. See *Melting*.
 metallographic etching, 682.
 metallography, book, 132 (review).
 metallurgy, advances, 80.
 milling. See *Milling*.
 molten, oxide films on, 687; soly. of hydrogen, 553.
 monument, effect of 50 yrs.' exposure, 123, 732.
 mosaic structure, effect of purity, 56.
 moulding. See *Moulding*.
 nickel-plating. See *Deposition*.
 occurrence, 732.
 oxide layer, 231; elect. properties, 169.
 painted, corrosion-resistance, accelerated tests, 234.
 painting. See *Painting*.
 paints, durability, 61; flexible, 315; for protection of iron, 523; for water tank interiors, 700; for wood, 402; in textile industry, 79; leafing, 432; priming on wood, tests, 542; protection of metals with, 234; Ultra Fuson, 234; with coal-tar, 298.
 parachor, 564.
 passivity, 454.
 photoelectric thresholds in turned state, 93.
 physical constants, 1.
 pistons, operating temps. in 12-in. bore oil engine, 261.
 plasticity, effect of purity, 56.
 plates, A.S.T.M. specifications, 123; manuf., 231.
 plating on. See *Deposition*.
 polishing. See *Polishing*.
 porosity of castings, 70.
 powder and tar, protective value, 385; in road surfaces, 315; manuf., Hame-tag process, 258; use in core-dressings, 625.
 pressing. See *Pressing*.
 pressings, properties, 186.
 production from Washington ores, pamphlet, 129.
 protection, 732; by chem. deposits, 232; see also *Anodic oxidation*, &c.
 protective coatings on, prodn., 158.
 purification by sublimation in vacuum, 2, 454.
 purity, effect on properties & working, 1; rate of annealing after cold-work as criterion of, 137, 273, 323.
 qualities, test, 1.
 recrystallization, 511, 587, 685; anisotropic rate of growth of new grains, 220; of castings, 454, 512; of single crystals, 553; x-ray study, 453, 554, 655.

Aluminium.

recrystallized, effect of purity on plasticity & mosaic structure, 56.

refined, properties, 365, 497, 655.

refining. See *Refining*.

reflectivity, effect of surface treatment, 2; ultra-violet, 416.

reflectors for telescopes, 640, 733.

riveting. See *Riveting*.

rods composed of large crystal grains, Young's modulus, 333.

rolling. See *Rolling*.

rolling texture, 99.

roofing, 34; insulation from concrete, &c., 123; jointing, 123.

sawing. See *Sawing*.

scrap, treatment, 395.

secondary, industry, 718.

separation. See *Analysis*.

service characteristics, 1.

shear limit, 56.

sheet, A.S.T.M. specifications, 123; protection, in aircraft, 17; use for surveying plans, 188; weathering, 17, 85.

single crystals. See *Single crystals*.

soldering. See *Soldering*.

solid viscosity, 336.

sound records, 315.

specifications, 732.

spraying. See *Spraying*.

standards, German, 541; Russian, 261.

statistics, 78, 401, 646, 731, 732, 733; Austrian, 78.

steel-cored cables, breaking length, 186; effect of vibration, 448; German specifications, 640; properties, 314; span calculation, 402.

structure, effect of purity, 1.

structures, 315, 486, 545.

superconductivity, 413.

surface treatment, 61, 164, 231, 519, 523.

-surfaced mirrors, reflectivity, 137.

taste, 48.

technology, books, 411, 493 (*review*).

test-pieces broken dynamically, x-ray study, 685.

thermal conductivity, effect of cold-work, 277.

thermal properties, 2.

thermoelectric effect, longitudinal, 453.

torsion diagrams, 356.

toxicity, 34, 638, 639, 650; bibliography, 638.

transition at 79° C., 41.

tubes for cream, 731; in textile industries, 731; joints, 37.

turning. See *Turning*.

uses, 78, 79, 185, 401, 541, 731; book, 267; see also various entries above.

utensils, roughness, cause, 723.

vapour pressure, 209.

volume changes on solidification, 279.

welding. See *Welding*.

welds, impact strength, 77.

wire, alternate bend strength, 438; copper specks on, 116; crystal orientation, effect of method of working, 16; for elect. conductors, German specifications, 640; rolled, detection

Aluminium,

of copper flecks, 31; thin, prepn. by freezing molten metal, 501; vibration endurance strength, 199.

wire-drawing. See *Wire-drawing*.

wire fabrics, uses, 645.

wool, as packing for joints, 542.

working, book, 194 (*review*).

works, elect., in W. Europe & U.S.A., 646.

Aluminium alloys. See *Alloys*.

Amalgams. See *Alloys: Mercury alloys*.

America. See *United States of America*.

Ampco. See *Alloys*.

ANALYSIS, METHODS OF—**Analysis,**

books, 189, 266.

flame, 241.

magneto-optic, 352.

metallurgical, book, 86; review, 479.

microchemical, 23; bibliography for 1934, 528.

nephelometric in metal industry, 303.

potentiometric, book, 330 (*review*).

qualitative, books, 81, 549; by drop reactions, books, 83, 650; spectral, of pure metals, 23; tables, 651.

quantitative, books, 408, 549, 742 (*review*); grav., by thermobalance using anthranilic acid, 24; x-ray, review, 705.

reagents, organic book, 329 (*review*).

spectroscopic, 106; appns., 241; automatic measurement, reduction & recording of wavelengths, 705;

bibliography, 412 (*review*); book, 492; effect of particle size on intensity, 611; history, 169;

illumination of spectrograph, 389; metallurgical, book, 330 (*review*);

purification of graphite electrodes, 705; qual., tables, 330 (*review*);

quant., 389, 705, 706; tables, 706.

volumetric, books, 135 (*review*), 651.

x-ray, 23.

Analysis of—

Aluminium, book, 493 (*review*); contg.

carbides, 241; nephelometric, 303;

quant., micro-, 169; spectrographic, 388, 476, 706.

Aluminium alloys, 610, 707; rapid,

476; spectrographic, 23, 64, 476.

Aluminium-iron-nickel alloys, 529.

Arsenic, nephelometric, 303.

Babbitt metal, 305.

Brasses, rapid, 614.

Cadmium, spectrographic, 706.

Cadmium plating baths, 303.

Chromium-nickel alloys by HClO₄, 476.

Chromium-plating baths, 66, 171, 303, 436.

Constantan, quant., potentiometric, 708.

Copper, nephelometric, 303; spectrographic, 23, 24, 611, 706.

Copper alloys, quant. spectroscopic, 611, 707.

Copper plating baths, 303.

Analysis, methods of—

Analysis of—

- Die-castings, spectrographic, 352, 705.
 Duralumin, quant. spectrographic, 64.
 Electrical heating materials, A.S.T.M. methods, 170.
 Electrodeposits, 610; electrographic, 611.
 Elektron, 303, 529.
 Ferro-aluminium by 8-hydroxyquinoline, 242.
 Ferro-molybdenum, A.S.T.M. standard methods, 610.
 Ferro-tungsten, A.S.T.M. standard methods, 610.
 Gases from industrial furnaces, 241.
 Germanium by Ge_2N_4 , 353.
 Gold-palladium-silver alloys, 242.
 Gold-platinum-silver alloys, importance of attack by H_2SO_4 , 353.
 Lead, nephelometric, 303.
 Lead-tin alloys, spectrographic, 242.
 Magnesium, contg. carbides, 241; nephelometric, 303.
 Mercury, nephelometric, 303.
 Nickel alloys, quant. spectrographic, 705.
 Nickel-brass, quant., potentiometric, 708.
 Nickel-phosphor-bronze, 708.
 Nickel plating baths, 243, 303, 611.
 Nickel, quant., potentiometric, 708.
 Niobium, 478.
 Osmium, refined, 242.
 Platinum, 242; in U.S.S.R., 708; spectrographic, 707.
 Platinum alloys, spectrographic, 707.
 Rhodium, in U.S.S.R., 708.
 Silver, nephelometric, 303; spectrographic, 23, 170.
 Silver alloys, streak tests, 435.
 Silver plating baths, 303.
 Stellite, 707.
 Tantalum, 478.
 Tin, spectrographic, 23.
 Tin plating baths, 303.
 Tinplate, 709.
 Widia, 709.
 Zinc, nephelometric, 303.
 Zinc alloys, quant. spectrographic, 705, 707; rapid, 243.
 Zinc plating baths, 303.

Assaying, cupellation losses, 708.

Assay of—

- Gold, sources of error, 64.
 Iridium in ingots, in U.S.S.R., 708.
 Palladium in ingots, in U.S.S.R., 708.
 Platinum in ingots in U.S.S.R., 708; sources of error, 64.
 Rhodium in ingots, in U.S.S.R., 708.

Detection of—

- Alkali metals by arc spectra, curves of sensitiveness, 612.
 Aluminium, 171, 435.
 Antimony, micro-, 170.
 Arsenic by Hg_2Cl_2 , 24.
 Barium, by flame analysis, limiting concn., 241.
 Beryllium by drop reaction, 709.

Analysis, methods of—

Detection of—

- Bismuth, 709; by thioglycol acids & thionalide, 612; in Cu by "synthetic spectrum," 25; micro-, 170; micro-, by hexanitrodiphenylamine, 710; with S-contg. compds., 304.
 Cadmium, as cyanide, 389; by flame analysis, limiting concn., 241; in Ag, spectrographic, 23, 170.
 Cæsium, by flame analysis, limiting concn., 241; micro-, by hexanitrodiphenylamine, 710; spectrographic, 244.
 Calcium, by flame analysis, limiting concn., 241; in presence of Sr & Ba, 24.
 Chromium by flame analysis, limiting concn., 241.
 Cobalt, by flame analysis, limiting concn., 241; by spot reaction, 170; fractional, 709.
 Copper, by flame analysis, limiting concn., 241; by flame analysis, use of CCl_4 , 25; by *para*-aminophenol hydrochloride, 389; by thioglycol acids & thionalide, 612; fractional, 477; spot method, 709.
 Erbium by flame analysis, limiting concn., 241.
 Gallium, 611.
 Gold, by CO, 614; by flame analysis, limiting concn., 241; by Hg_2Cl_2 , 24; micro-, 170, 436; rapid, 65.
 Impurities (non-metallic), 612; (traces), by Poulson arc, 352.
 Indium, 611.
 Iridium, micro-, 436.
 Iron, by flame analysis, limiting concn., 241; by *para*-aminophenol hydrochloride, 389.
 Lead, 477; by flame analysis, limiting concn., 241; in solder, 107; micro-, by hexanitrodiphenylamine, 710.
 Lithium, by flame analysis, limiting concn., 241; spectrographic, 244.
 Magnesium by flame analysis, limiting concn., 241.
 Manganese, by flame analysis, limiting concn., 241; by Krumm-Vollhardt reaction, 170.
 Mercury, by thioglycol acids & thionalide, 612; micro-, by hexanitrodiphenylamine, 710.
 Metals, by thioglycol acids, 612; by thionalide, 612.
 Neodymium by flame analysis, limiting concn., 241.
 Nickel by flame analysis, limiting concn., 241.
 Osmium, micro-, 436; micro-, by $(\text{CSNH}_2)_2$, 107.
 Palladium, 352; by flame analysis, limiting concn., 241; by Hg_2Cl_2 , 24; in Ag, spectrographic, 23, 170; micro-, 436; micro-, by $(\text{CSNH}_2)_2$, 107.
 Platinum, 352; by Hg_2Cl_2 , 24; micro-, 436; micro-, by $(\text{CSNH}_2)_2$, 107.

Analysis, methods of—

Detection of—

Platinum group metals, micro-, by $(\text{CSNH}_3)_2$, 107.

Potassium, by flame analysis, limiting concn., 241; micro-, by hexanitrodiphenylamine, 710.

Praseodymium by flame analysis, limiting concn., 241.

Precious metals in mixed soln., 24.

Radium by flame analysis, limiting concn., 241.

Rhodium, micro-, 436.

Rubidium, by flame analysis, limiting concn., 241; micro-, by hexanitrodiphenylamine, 710; spectrographic, 244.

Ruthenium, micro-, 436; micro, by $(\text{CSNH}_3)_2$, 107.

Selenium by Hg_2Cl_2 , 24.

Silver, 65; by flame analysis, limiting concn., 241; by thioglycol acids & thionalide, 612.

Sodium by flame analysis, limiting concn., 241.

Strontium by flame analysis, limiting concn., 241.

Tellurium by Hg_2Cl_2 , 24.

Thallium, 611; by flame analysis, limiting concn., 241; micro-, by hexanitrodiphenylamine, 710.

Tin, by cacotheline, 243; in Cu, spectrographic, 528.

Vanadium with 8-hydroxyquinoline, 24.

Yttrium by flame analysis, limiting concn., 241.

Zinc, fractional, 709.

Zirconium, micro-, by hexanitrodiphenylamine, 710.

Estimation of—

Alkali metals, in Al & its alloys, 529; in Mg & its alloys, 65, 529.

Aluminium, by drop method, 243; by 8-hydroxyquinoline, 475; by 8-hydroxyquinoline in presence of Fe, Ni, Co, Cu, Cr, & Mo, 66; by hydrogen ammonium carbonate, 530; by titration of excess hydroxyquinoline, 710; colorimetric with alizarin "S," 476; colorimetric, with Na alizarinsulphonate, 710; in Fe-contg. Cu-Zn alloys, 476; vol., 613, 710; vol., apparatus for, 171.

Aluminium oxide, in Al, colorimetric, 65; in Al & its alloys, 613; rapid, by 8-hydroxyquinoline, 710.

Ammonia in brass plating baths, 389.

Antimony, in alloys, 530; in alloys by KMnO_4 , 710; in Babbitt metal, 305; in Cu, spectrographic, 707; in Pb by elect. resistance measurement, 390; in solder, 24; in tin-foil, 293; in type metals, 25; in white metals, 24; vol., by $\text{Ce}(\text{SO}_4)_2$, 613.

Analysis, methods of—

Estimation of—

Arsenic, by Hg_2Cl_2 , 24; by NaH_2PO_2 , 530; in Cu, spectrographic, 707; vol., by $\text{Ce}(\text{SO}_4)_2$, 613; vol., potentiometric titration of reduced As soln. with KIO_3 in H_2SO_4 & HCl solns., 613.

Barium, in light alloys & solns., spectrographic, 352.

Beryllium, 610; by 8-hydroxyquinoline, 475; by quinalizarin, 711; in presence of F, vol., 66.

Bismuth, by H_2SeO_3 , 530; by thioglycol acids & thionalide, 612; by thionalide, 613; in Cu, 106, 476, 613; in Cu by "synthetic spectrum," 25; in Cu, spectrographic, 707; in cupelled Ag, 244; in presence of Cu & Cl' , 66.

Boric acid in Ni-plating baths, 243, 611.

Boron, spectroscopic, 389.

Cadmium, by anthranilic acid, 243; by hydroxyquinoline, 171; depn. from pyrophosphate soln., 529; electrolytic, 171, 353; grav., by alcoholic mercaptobenzthiazole, 530; rapid, 171; vol., 66.

Cæsium, spectrographic, 244.

Calcium, as CaC_2O_4 , in presence of AsO_4''' , 353; in light alloys & solns., spectrographic, 352.

Cerium by gallic acid, 476.

Chromium in CrO_3 plating baths, 171, 436.

Citric acid in Ni plating baths, 611.

Cobalt, by α -nitroso- β -naphthol, 353; by anthranilic acid, 243; by complex compd., 390; by dimethylglyoxime-benzidine, 477; by pptn. as CoS , 477; depn. from pyrophosphate soln., 529; vol., 25.

Copper, argentometric, 390; by anthranilic acid, 243; by quinaldinic acid, 436; by salicylaldoxime, 171, 172; by thioglycol acids & thionalide, 612; by thionalide, 613; depn. from pyrophosphate soln., 529; electrolytic, 66; grav., by alcoholic mercaptobenzthiazole, 530; grav., by tannin, 67; grav., macro & micro, 614; in alloys without prelim. sepn., 615; in Al alloys, elect., 614; in Babbitt metal, 305; in brass, rapid, 614; in Cr plating baths, 66; in Cu-Pd alloys, 107; in Pt metals, in U.S.S.R., 708; in Zn, elect., 614; iodometric, 171; micro-, 390; potentiometric, by Na_2S , 304; quant., rapid potentiometric, 25; rapid, without prelim. sepn., 614; vol., by K_2SnCl_6 , 66.

Gases in metals, vacuum fusion method, improvement, 710.

Germanium, colorimetric, by germanomolybdic acid, 353; in Cu & Fe, spectrographic, 706; in presence of As, 477.

Analysis, methods of—

Estimation of—

Gold, by CO , 614; by Hg_2Cl_2 , 24; in alloys, micro-, 390; in presence of Pd & Sn, 436; in U.S.S.R., 708.

Indium, bibliography, 138.

Iridium, in U.S.S.R., 708; micro-, 354; potentiometric, 245.

Iron, depn., from pyrophosphate soln., 529; electrolytic, 66; in Cr plating baths, 66; in Duralumin, quant. spectrographic, 107; in Pt metals, in U.S.S.R., 708; in presence of Ti, aeration process, 711; rapid, 712; rapid, without prelim. sepn., 614.

Lead, by anthranilic acid, 390; elect., as PbO_2 , 530; grav., as Pb salicylaldoxime, 172, 530; in alloys, quant., 711; in alloys contg. Sb, Cu, & Zn, vol., 304; in alloys contg. Sn, Sb, & Cu, vol., 477; in bearing metals, vol., 67; in Cu, 354; in Cu, spectrographic, 707; in Cu & Cu-Zn alloys, elect., 615; in cupelled Ag, 244; in Pb-Sn alloys, spectrographic, 242; in solder, 107; in Sn, spectrographic, 615; in type metals, 25; in Zn, elect., 615; micro-, 244; microvol., 711; on Pb-coated Fe, 304; quant., as $\text{Pb}_2\text{H}_4(\text{IO})_2$, 25; rapid, 171; vol., with K_2SO_4 , 711.

Lead oxide in metallic Pb, 711.

Lithium, spectrographic, 244, 305, 389

Magnesium, as $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$, 391; as MgO in presence of NH_4^+ , 711; by 8-hydroxyquinoline, 67, 475; colorimetric, 67; electrometric, with Sb electrode, 477; in Duralumin, quant. spectrographic, 107; in products of recovery of Mg, 436; micro-, 244; nephelometrically, 172; vol., 615.

Manganese, by anthranilic acid, 243; comparison of methods, 172; in Cr-Co alloys, ferrocobalt alloys & Co high-speed steels, 304; in Duralumin, quant. spectrographic, 107; in Mg alloys, quant. spectrographic, 707; micro-, 108; vol., 354; vol., by induced oxidation from manganous salt to manganimeta-phosphoric acid, 531; vol., by titration with $\text{K}_2\text{Fe}(\text{CN})_6$, 711.

Mercury, alkalimetric, 67; by anthranilic acid, 390; by thioglycol acids & thionalide, 612; by thionalide, 613; potentiometric, 108; rapid, 711; vol., 108.

Metals, by anthranilic acid, importance of pH , 243; interference of Mn, 304.

Molybdenum, colorimetric, by cyclohexanol, 25.

Nickel, as sulphide in buffered solns., 478; by anthranilic acid, 243; depn., from pyrophosphate soln., 529; in plating baths, rapid, 303; vol., 25.

Analysis, methods of—

Estimation of—

Palladium, by Hg_2Cl_2 , 24; in Cu-Pd alloys, 107.

Phosphorus, in Al, 169; spectroscopic, 389.

Platinum, by Hg_2Cl_2 , 24; in U.S.S.R., 708; micro-, 354; potentiometric, 245; quant., drop method, 712.

Polonium in radio lead, 615.

Potassium, in Mg, 65; micro-, 354; spectroscopic, 389.

Rare earths, quant., magnetic, 708.

Rhenium, colorimetric, 712.

Rhodium in U.S.S.R., 708.

Rubidium, in U.S.S.R., 708; spectrographic, 244.

Selenium by Hg_2Cl_2 , 24.

Silicon, in Al, 169; in Al alloys, 108;

in Al alloys, rapid photometric, 531;

in Duralumin, quant. spectrographic,

107; in Mg alloys, quant. spectro-

graphic, 707; spectroscopic, 389.

Silver, by thioglycol acids & thionalide,

612; by thionalide, 613; grav., 108;

in alloys, micro-, 390; in alloys

without prelim. sepn., 615; potenti-

ometric titration, 712; vol., 478.

Sodium, in Mg, 65; spectroscopic, 389.

Strontium, spectroscopic, 389.

Sulphur in ferromagnetic alloys, rapid, 479.

Sulphuric acid in chromium plating baths, 303.

Tellurium, by Hg_2Cl_2 , 24; in Pb alloys,

26, 305; spectroscopic, 389.

Thallium, electrometric, 615; spectroscopic, 389.

Thorium, with 8-hydroxyquinoline, 305; with picrolonic acid, 304.

Tin, by phenylarsonic acid, 478;

in Babbitt metal, 305; in bearing

metals by $\text{Ce}(\text{SO}_4)_2$, 26; in Cu, 67;

in Cu, spectrographic, 707; in Pb-

Sn alloys, spectrographic, 242; in

sludges, 67; in type metals, 25;

oxidimetric, 67; vol., 436; vol.,

with $\text{Ce}(\text{SO}_4)_2$, 391.

Titanium, by gallic acid, 476; vol., as TiO_2 , 531.

Tungsten, vol., 26.

Uranium, rapid, 712.

Vanadium, rapid, 712.

Zinc, 172, 478; by anthranilic acid,

243; by pptn. as ZnS use of sul-

phate-hydrosulphate buffered soln.,

616; by quinaldine acid, 437;

colorimetric, with dithizone, 305;

depn. from pyrophosphate soln.,

529; electrodepn. from acid solns.,

531; electro. in presence of Fe, 242;

in brass, rapid, 614; in Cu alloys

contg. <0.5% Zn, 712; in Au &

bronze pigments, rapid, 478; in Mg

& Elektron, vol., 616; in Ni, 436; in

presence of Fe, Al, U, Be, & Ti with

quinaldine acid, 305, 437; iodo-

metric, 354; micro-, with anthra-

nolic acid, 437; rapid, without pre-

lim. sepn., 614; vol., indirect, 354.

Analysis, methods of—**Estimation of—**

Zirconium, 478; with 8-hydroxyquinoline, 391; with normal propylarsonic acid, 712.

Sampling of—

Silver coin, 709.

Separation of—

Aluminium, & Be, 435; & Fe from Be with *o*-oxyquinoline, 107; by organic reagent, 612; from Ni & Co by hydrazine carbonate, 352.

Arsenic by Hg_2Cl_2 , 24.

Barium in Cu-Sn group, 24.

Beryllium from Al & Fe, 65.

Bismuth by thionalide, 613.

Chromium, by organic reagent, 612; from Ni, Co, & Fe, 243.

Cobalt, by NaOH & Na_2O_2 , 612; from Fe, 352.

Copper, & Cd by salicylaldehyde & electrolysis, 171; & Cd by salicylaldehyde & hydroxyquinoline, 171; & Pb by salicylaldehyde, 172; by anthranilic acid, 243; by thionalide, 613; from As, Sb, & Sn, 529; from Cd & Mn, 436.

Europium from rare earths, 710.

Gold by Hg_2Cl_2 , 24.

Iridium & Pt in U.S.S.R., 708.

Iron, by organic reagent, 612; by NaOH & Na_2O_2 , 612; from In with cupferron, 24.

Manganese at Hg cathode, 612.

Mercury by thionalide, 613.

Metals by anthranilic acid, 243.

Molybdenum from Re, 712.

Nickel, & Co, quant., 389; by NaOH & Na_2O_2 , 612.

Niobium & Ta, 477.

Palladium by Hg_2Cl_2 , 24.

Platinum by Hg_2Cl_2 , 24.

Rare earths, 710.

Ruthenium from Pt, Pd, Rh, & Ir, pamphlet, 83.

Samarium from Nd, partial, 710.

Selenium, by Hg_2Cl_2 , 24; from Cd, Pb, Bi, Sb, Mo, W, & V, 389.

Silver by thionalide, 613.

Tantalum & Nb, 477.

Tellurium by Hg_2Cl_2 , 24.

Tin with HNO_3 , 529.

Tungsten from Nb, Ta, Ti, & Zr, 478.

Zinc, by NaOH & Na_2O_2 , 612; from Cr, 243; from Mn, 437; in Au & bronze pigments, rapid, 478.

Annealing (see also *Heat-treatment*),

bright-, 358, 445; in elect. furnaces, 256; methods, 627.

furnaces. See *Furnaces*.

Annealing of—

Aluminium, 74, 256; effect of impurities, 137, 273, 323.

Aluminium alloys, 74; changes in length, 95.

Brasses, 116; advances, 73; book, 411 (review).

Annealing of—

Bronzes, 116.

Copper, (H.-C.) wire, 31; wire, bright-, 627.

Copper alloys, 116.

Nickel-brass, 116.

Palladium & its alloys, 140, 660.

Platinum & its alloys, 140, 660.

Anodic oxidation of—

Aluminium & its alloys, 1, 103, 158, 164, 231; Alumilite process, 520; appns. 61, 385; chem. & phys. structure of protective layer, 600; conditions for formation of film, 519, 695; elect. properties of oxide layer, 169; Eloxal process, 231; Eloxal process, appns., 20; Eloxal process, dielectric behaviour of films, 600; Eloxal process, plant, 163; Eloxal process, properties of films, 20, 163, 296; patents, American, 296; protection & decoration by, 695; regulation of oxalic acid soln., 695.

Anodic polarization. See *Polarization*.

Anticorodal. See *Alloys*.

Anti-friction alloys. See *Alloys: Bearing alloys*.

Antimony,

amorphous, 454, 554; molecular arrangement, 554; structure, elect. conductivity, & rate of crystn., 554.

chemical thermodynamics, book, 407.

contamination of foods, 543.

deposition. See *Deposition*.

detection. See *Analysis*.

electrophoretic, 655.

estimation. See *Analysis*.

explosive. See *Antimony, amorphous*.

films, reflectivity, 48; transparency in ultra-violet, 276.

magnetic susceptibility of powders, variation with particle size, 565.

photoelectric thresholds in turned state, 93.

polished surfaces, structure, 590.

single crystals. See *Single crystals*.

statistics, 733.

thermal expansion, 333.

vaporization, heat, 377.

Antimony alloys. See *Alloys*.

Apparatus, laboratory. See *Laboratory apparatus*.

Arc. See *Electric arc*.

Area, apparatus for measurement, 354.

Armite. See *Alloys*.

Arsenic,

analysis. See *Analysis*.

atomic weight, 497.

chemical thermodynamics, book, 407.

contamination of foods, 543.

deposition. See *Deposition*.

detection. See *Analysis*.

estimation. See *Analysis*.

films, transparency in ultra-violet, 276.

glassy state, 197.

separation. See *Analysis*.

statistics, 733.

Arsenic alloys. See *Alloys*.

Asarcology. See *Alloys*.

Asbestos, corrosion by. See *Corrosion*.

- Assaying.** See *Analysis*.
- Atmospheric corrosion.** See *Corrosion*.
- Atomic changes** under pressure, 666.
- Atomic structure**, bibliography of text-books, 39.
- Atomic weights** (see also under names of metals),
reports of cttee. of Internat. Union of Chemistry, 93, 416, 666.
- Atoms**,
adsorbed at surfaces, equilibrium, 93.
metallic, force of repulsion, 46.
- Australia**,
Broken Hill Propy. Co., Ltd., history, 545.
Council for Scientific & Industrial Research, report, 318.
libraries, catalogue of periodicals, 127.
metallurgical resources, 405.
- Austria**, aluminium statistics, 78.
- Automobiles**,
bearings, main & connecting-rod, crack-
ing, 10.
inspection of material, 618.
materials, 543, 732; substitutes, 452
(see also *Alloys* & under names of
metals).
non-ferrous metals in, 127.
pistons. See *Alloys: Aluminium alloys*,
&c.
- B.B. alloy.** See *Alloys*.
- Babbitt metals.** See *Alloys*.
- Bacteria**, action of metals on. See under
names of metals.
- Barium** (see also *Alkaline earth metals*),
clean-up of gases by, 36.
contact p.d. between tungsten &, 368.
detection. See *Analysis*.
estimation. See *Analysis*.
melting point, 454.
sputtering from tungsten, 457.
statistics, 733, 738.
uses, 79.
work-function, 368.
- Barium alloys.** See *Alloys*.
- Barkhausen effect**, 581; see also under
names of metals.
- Barronia.** See *Alloys*.
- Bars**, sampling, 713.
- Bearing alloys.** See *Alloys*.
- Bearings**,
automobile engine, from designer's
point of view, 451; from mfrs. point
of view, 451; main and connecting-
rod, cracking, 10.
cracking, 10, 12.
lubrication, 317.
oil-saving & oil-less, 641.
reconditioning, 308.
roll neck, maintenance, 360.
rolling-mill, composite, 74.
- Beilby layer**, 288.
- Bells**, founding, 624.
- Bend testing.** See *Testing*.
- Bending strength.** See *Alloys* & under
names of metals.
- Benedicks effect**, interpretation, 667.
- Beryllium**,
allotropy, 454.
atomic structure factor, 221.
cementation of metals by, 697.
chemical properties, 41.
conduction electrons, 41.
corrosion. See *Corrosion*.
detection. See *Analysis*.
electrode potential, 239.
estimation. See *Analysis*.
industry of U.S.S.R., 80.
manufacture, 365.
occurrence, 663.
optical constants, 41.
physical properties, 41.
properties, 365; review, 663.
purification by sublimation in vacuum,
2, 454.
separation. See *Analysis*.
statistics, 80, 738, 740.
uses, 41, 79, 262, 365, 403, 663.
vapour pressure, 209.
- Beryllium alloys.** See *Alloys*.
- Bimetal**,
brass-base, manuf., 725.
iron-Tombak, control of density in
plating & microstructure, 605.
rolling. See *Rolling*.
tubes in gas appliances, 599.
- Binary alloys.** See *Alloys*.
- Binding forces** in metals, theory, 562.
- Biography**, 88 (*review*).
- Birmabright.** See *Alloys*.
- Birmasil.** See *Alloys*.
- Bismuth**,
chemical thermodynamics, book, 407.
crystal lattice, 681.
crystals, intensities of x-ray reflection,
221; twinning, 685.
deposition. See *Deposition*.
detection. See *Analysis*.
diamagnetism, 42, 681.
electrical conductivity of single crystals,
change in magnetic field, 497, 567.
electrical resistance of single crystals,
change at m. p., 365.
electrode potentials, 609.
estimation. See *Analysis*.
films, crystalline, structure, 591; elec-
tron diffraction patterns, 225; mag-
neto-resistance, 365; reflectivity, 48;
transparency in ultra-violet, 276.
galvano-magnetic effects, effect of rate of
cooling, 2.
Hall effect, effect of rate of cooling, 2.
magnetic susceptibility of powders,
variation with particle size, 565.
magneto-resistance, 137, 198.
magneto-striction, 681; of single crystals,
89.
mean free path of electrons, 365.
micro-crystals, size & arrangement, 365,
554.
molten, oxide films, electron diffraction
study, 99.
occurrence, 733.
oxidation, surface, 294.
Peltier heat, 49.
photoelectric thresholds in turned state,
93.

- Bismuth**,
 plasticity, effect of occluded gas, 655.
 production, 733.
 properties, 733.
 separation. See *Analysis*.
 single crystals. See *Single crystals*.
 statistics, 738, 740.
 superconductive, penetration of transverse magnetic field, 277.
 supercooling, 207.
 thermal conductivity of single crystals, effect of magnetic field, 41, 497.
 thermal expansion of single crystals near m.p., 41; x-ray detn., 274.
 thermal resistance of single crystals at low temps., detn., 198.
 thermomagnetic effects, effect of rate of cooling, 2.
 transitions, high-pressure, 197.
 uses, 733.
 wetting power, 501.
 wires, thin, prepn. by freezing molten metal, 501.
- Bismuth alloys**. See *Alloys*.
- Bitter's patterns**, 595.
- Bleaching agents**, corrosion by. See *Corrosion*.
- Bleaching (textile) apparatus**, materials for, 17.
- Blekor**. See *Alloys*.
- Blower systems**, book, 649.
- Bolts**, tensile properties, impact & static, 339.
- Borium**. See *Alloys*.
- Boron**, statistics, 738.
- Boron carbide**. See *Alloys*.
- Brasses**. See *Alloys*.
- Brazing**,
 advances, 485.
 electric-furnace, 184, 398.
 in controlled atmosphere electric furnaces, 540.
 with silver solders, 120, 485.
- Brazing of—**
 Copper pipes, 540.
 Gun-metal fittings, 540.
 Machine parts in elect. furnace, 120.
 Monel metal, 121.
 Refrigerator plant, 184.
 Stainless steels with silver solder, 76.
 Steel, 540.
 Superhard alloys to bits by natural gas, 727.
- Breaking stress**. See *Tensile properties*.
- Brewery**,
 constructional materials, 317; see also *Alloys & under names of metals*.
 vessels, corrosion. See *Corrosion*.
- Brinell hardness**. See *Hardness, Testing, & Testing machines*.
- Brines**, corrosion by. See *Corrosion*.
- Britannia metal**. See *Alloys*.
- Brittleness** (see also *Alloys & under names of metals*),
 422.
 mechanism, 290.
 of sheets, 74.
- Bronzes**. See *Alloys*.
- Bronzing**, book, 545.
- Buckling of linked beams**, 479.
- Buffing** (see also *Polishing*),
 259, 312.
 books, 134 (*review*), 653 (*review*).
 economical, 726.
- Buffing of—**
 Antimony-lead alloys, 726.
 Brass, effect of annealing atm., 447.
 Britannia metal, 726.
 Cadmium, 726; deposits, 362.
 Gold, 726.
 Lead, 726.
 Pewter, 726.
 Platinum, 726.
 Tin sheet, 726.
- Building**, metallic materials, 126; see also *Alloys & under names of metals*.
- Burma**, mineral resources, book, 406.
- Burnishing**, 634, 726.
- Butter**,
 action on metals. See *Corrosion*.
 keeping quality, effect of foils, 542.
- Cables** (see also *Alloys & under names of metals*),
 breaking length, 186.
 high-tension, vibrations, 189.
 jointing, 635; book, 552 (*review*).
 manufacture, book, 194 (*review*).
 properties, book, 194 (*review*).
 protection against elect. corrosion, 348.
 sheathing, defects, 658; see also *Alloys & under names of metals*.
 vibrations, damping, 449.
- Cadmium**,
 analysis. See *Analysis*.
 buffing. See *Buffing*.
 chemical thermodynamics, book, 407.
 cold-work, recovery from, review, 142.
 colouring. See *Colouring*.
 corrosion. See *Corrosion*.
 deposition. See *Deposition*.
 deposits, protective value, 296; structure, 592.
 detection. See *Analysis*.
 electrical resistance, at low temps., 554; of films, 198.
 electrode potentials in liquid ammonia, 704.
 electron diffraction patterns, 591.
 entropy, 564.
 estimation. See *Analysis*.
 films, elect. resistance, 198; electron diffraction patterns, 225.
 gases in, removal, 704.
 molten, oxide films on, 687.
 parachor, 564.
 poisoning, 35.
 polished surfaces, structure, 590.
 separation. See *Analysis*.
 situation in U.S.S.R., 452.
 solutions in molten CdCl_2 & calomel, magnetic properties, 656.
 spectra, ultra-violet, 459.
 sprayed deposits, tests in alkaline liquors, 602.
- spraying**. See *Spraying*.
- sputtered**, surface motion of particles, 93.
- statistics**, 738, 740.

- Cadmium**,
 superconductivity, 656; transition temp., 568.
 thermal expansion, x-ray detn., 202, 656.
 vapour pressure, 502.
 viscosity, 498.
 wires, thin, prepn. by freezing molten metal, 501.
- Cadmium alloys**. See *Alloys*.
- Cæsium** (see also *Alkali metals*),
 atomic weight, 555.
 detection. See *Analysis*.
 estimation. See *Analysis*.
 Halleffect, 140.
 magnetic moment of nucleus, 2.
 molecular weight, 54.
 occurrence, 663.
 positive ions, action on hot nickel surface, 91.
 properties, review, 663.
 thermoelectric force, 456.
 uses, 663.
 vapour, spontaneous ionization at incandescent tungsten & rhenium surfaces, 45.
- Cæsium alloys**. See *Alloys*.
- Calcium** (see also *Alkaline earth metals*),
 action of mercury vapour, 138.
 allotropy, 555.
 clean-up of gases by, 36.
 detection. See *Analysis*.
 estimation. See *Analysis*.
 melting point, 454.
 metallurgy, 199.
 photoelectric threshold, change when treated with small amts. of O_2 , 501.
 production, electrolytic, 239.
 pure, properties, 413, 497, 656.
 purification by sublimation, 202.
 statistics, 738.
 uses, 79.
 vapour pressure, 42.
- Calcium alloys**. See *Alloys*.
- Calcium chlorateliqours**, corrosion by. See *Corrosion*.
- Calorizing** of oil-refining pipe-still tubes, 696.
- Canada**,
 aluminium industry, 646.
 Canadian Manufacturers Association, trade index, 545.
- Carbides**. See *Alloys & compounds*.
- Carboly**. See *Alloys*.
- Carbon dioxide**. See *Gases*.
- Carbon monoxide** (see also *Gases*),
 adsorption by copper, 656.
- Caro bronze**. See *Alloys*.
- Castability**, 534, 621 (see also *Alloys & under names of metals*).
- Casting** (see also *Moulding, &c.*),
 advances, 112.
 books, 190, 651 (review).
 centrifugal. See *Centrifugal casting*.
 cire perdu method, 394.
 die-. See *Die-casting*.
 Durville process, 112.
 gravity. See *Die-casting*.
 metal rising from gate & riser, 250.
 methods, review, 717.
 mould capacity, 534.
- Casting**,
 pressure. See *Die-casting*.
 properties, 534.
 R.W.R. process, 112.
 volume changes during. See *Volume changes*.
- Casting of—**
Aluminium, 112; book, 493; caps, thin-walled, 358; effect of silicon in presence of other elements, 622; errors, 393, 534; gates & risers, book, 552 (review); in sand, effect of melting conditions, 29, 84; pistons in metal moulds, 622; prevention of unsoundness, 393; review, 622; vacuum-, 176; wire-bars & plates, 622.
- Aluminium alloys**, 1, 29, 70, 250, 307; chill-, 535; difficulties, 250; effect of feeding, &c., 281; in metal moulds, causes of rejects, 70; ingots for rolling, 534; moulds for, 535; shrinkage, 95; shrinkage cracks caused by casting-in bearing bush, 29.
- Aluminium-bronzes**, 30, 582; control, 70; difficulties, 358.
- Aluminium-copper alloys**, 622; in sand, effect of melting conditions, 29, 84.
- Bells**, 624.
- Brasses**, 112, 717; book, 411 (review); covers (large), 394; difficulties, 250; Doehler process, 112; from induction furnaces, 251; gates & risers, book, 552 (review).
- Bronzes**, 71, 251, 394, 622, 623; bushes in metal moulds, 71; difficulties, 250; factors affecting compactness & soundness, 623; from reverberatory furnaces, prodn. of oxide-free, dense ingots, 624; gates & risers, book, 552 (review); pouring temp., 177, 251, 307; thin-walled castings, defect, 394.
- Cadmium alloy bearings**, 214.
- Copper**, vertical, 177.
- Copper alloys**, 112.
- Duralumin**, effect of dust films, 250.
- Lead-bronze**, bushings, 624; causes of porosity, 624.
- Magnesium alloys**, 1, 71, 251; chill-, 177, 624; review, 624.
- Manganese-brass**, 97, 582.
- Molybdenum** button in brass for x-ray target, 532.
- Nickel-brass**, 394.
- Pewter**, 178.
- Phosphor-bronzes**, 177, 307.
- Propellers**, 307, 308, 358, 481.
- Silumin**, 250.
- Silver**, 481; for rolling, faults, 631.
- White metals**, 112, 625; bearings for locos., 125.
- Zinc**, effect of rapid cooling on lead distribution, 441; tests with commercial spelter, 535.
- Zinc-bronzes**, 481.
- Castings**,
 blisters, 393.
 blow-holes, filling by metal spraying, 698.

- Castings.**
 book, 651 (*review*).
 defects, spongy spot, 717.
 gates & risers, book, 552 (*review*).
 heat-resisting, use of long-time creep-test data in design, 70.
 improvement, discussion, 716.
 large, prodn., 621.
 porosity, 307.
 quality, factors affecting, 716.
 radiology. See *Radiology*.
 shrinkage, effects, 534.
 surface defects, elimination, 357.
 unsoundness, factors affecting, 357.
- Catalysis**, adsorption theory, 661.
- Cathode rays**, reflection from crystal surface, 591.
- Cathodic sputtering.** See *Sputtering*.
- Cavitation**, 347.
- Cellometal**, 262.
- Cellulose production**, corrosion in. See *Corrosion*.
- Celsite.** See *Alloys*.
- Celium.** See *Hafnium*.
- Cement**, corrosion by. See *Corrosion*.
- Cementation** (see also *Diffusion*),
 books, 129, 325 (*review*).
 by aluminium, 165.
 by beryllium, 697.
 by silicon powder, 522.
 by tin powder, 698.
 protective value, 164.
- Cementation of—**
 Copper, by aluminium, 165; by silicon powder, 522; by tin powder, 385, 698.
 Iron, 105; by aluminium, 165; by beryllium, 697; by chromium, 463; by silicon powder, 522; by tin powder, 385.
 Nickel, by aluminium, 165; by chromium, 463; by silicon powder, 522; by tin powder, 385, 698.
 Steels, 105; by beryllium, 697.
- Cements**, refractory. See *Refractory materials*.
- Centrifugal casting**, 308, 536.
 machines, 718.
- Centrifugal casting of—**
 Brass, 112.
 Bronze, 112.
- Ceralumin.** See *Alloys*.
- Cerium**,
 crystal lattice, 221.
 estimation. See *Analysis*.
 magnetic susceptibility, 221.
 preparation, 141, 199, 555.
 pure, prepn., 141.
 specific heat at high temps., 2.
 transition temperature, 2.
 uses, 79.
- Cerium alloys.** See *Alloys*.
- Cerrobaze.** See *Alloys*.
- Cerrobend.** See *Alloys*.
- Cerro-matrix.** See *Alloys*.
- Cerroseal.** See *Alloys*.
- Chaplets**, calculation of size, &c., 178.
- Cheese**, action on metals. See *Corrosion*.
- Chemical apparatus**,
 book, 408.
 construction, book, 136 (*review*).
- Chemical engineering**, book, 190.
- Chemical industry**,
 American, guide-book, 546.
 materials for, books, 85, 272 (*review*).
 645; see also *Alloys* & under names of metals.
 reference book, 496 (*review*).
- Chemical properties.** See under specific properties.
- Chemical technology.**
 German-English, book, 135 (*review*).
 in U.S.A., book, 491.
- Chemical thermodynamics**, book, 489.
- Chemicals**, manufacturers, British, directories, 127, 265.
- Chemist** as corrosion expert, 430.
- Chemistry**,
 analytical. See *Analysis*.
 applied, dictionary, 410; origins & development, book, 328 (*review*); progress, book, 194 (*review*).
 books, 410, 492, 544.
 constants, book, 546.
 dictionaries, 407, 410.
 handbooks, 328 (*review*).
 in U.S.A., book, 654 (*review*).
 industrial, book, 496 (*review*); in period 1635-1935, 490; work of 14th Congress, 489.
 of solids, book, 323 (*review*).
 physical, importance in applied electrochemistry, 388; tables, 408.
 profession, book, 321.
 progress in 1934, report, 654 (*review*).
 reference books, 84, 321, 489, 649.
- Cherries**, action on metals. See *Corrosion*.
- Chromic acid solutions**, aqueous, electrolytic reduction, cathodic film in, 302, 475.
- Chromite.** See *Refractory materials*.
- Chromium**,
 atomic weight, 555.
 bibliography, 138.
 cementation of metals by, 463.
 corrosion. See *Corrosion*.
 crystal structure of electrodeposits, 378, 470, 683.
 deposition. See *Deposition*.
 deposits, corrosion. See *Corrosion*; crystal structure, 378, 470, 683; hardness, effect of various factors. See *Deposition*; in building, 126; indust. appns., 433; porosity, 235; properties, 235; protective value, 20, 82; structure, 235; structure, relation to chem. & phys. properties, 469, 683; with high corrosion- & heat-resistance, 473.
 detection. See *Analysis*.
 diffusion into iron, x-ray study, 672.
 electrolyte, 239.
 electron diffraction patterns, 224.
 estimation. See *Analysis*.
 occurrence, 138.
 ores, 138.
 polished surfaces, structure, 590.
 purification by sublimation in vacuum, 2, 454.
 separation. See *Analysis*.
 sources, 138.

- Chromium.**
 specific heat at high temps., 2.
 statistics, 734.
 technology, advances, 734.
 transition temperature, 2.
 vapour pressure, 209.
- Chromium alloys.** See *Alloys*.
- Citric acid,** corrosion by. See *Corrosion*.
- Cleaning** (see also *Degreasing, Descaling, &c.*),
 360, 361.
 agents, 118, 447, 633; alkali, 397;
 corrosion by. See *Corrosion*; for use
 before painting, 397.
 baths, control, 312.
 by tumbling & burnishing, 539.
 developments, 259, 360.
 electrolytic, 633.
 for electro-galvanizing, 75.
 for metal spraying, 633.
 for plating, 361, 726.
 handbook, 650.
 in canning industry, 633.
 plant, chemical stoneware for, 447.
 review, 298.
 with wire brushes, 633.
- Cleaning of—**
 Aluminium, in household, 32; sheet,
 633.
 Copper, electrolytic, 446.
 Dairy plant, 447.
 Silver, antique coins, depn. of metallic
 copper, 311.
 Tinned surfaces, 311.
 Tinplate, 311, 633.
- Coal(s)** (see also *Fuels*),
 classification, A.S.T.M. specifications,
 114, 115; book, 492.
 combustion, accuracy of calculations,
 628; balance equation of, 626.
 powdered, as standard indust. fuel, 483;
 combustion, 537.
- Coating of metals.** See *Deposition, Galvanizing, Spraying, Tinning, &c.*
- Coatings.** See *Deposits*.
- Cobalt,**
 α - β transformation, heat change, 414.
 adsorption of hydrogen, 199.
 adsorption of nitrogen, 199.
 anodes in textile industry, 316.
 bibliography, 734.
 chemistry, books, 494 (*review*), 544.
 creep, 93.
 deposition. See *Deposition*.
 detection. See *Analysis*.
 effect on age-hardening alloys, 13.
 elasticity, Young's modulus, effect of
 magnetization, 565.
 electrical resistance, 502; change in
 longitudinal magnetic field, 414, 555.
 electron diffraction patterns, 224.
 estimation. See *Analysis*.
 industry in U.S.S.R., 739.
 magnetic susceptibility, dependence of
 frequency, 202.
 magnetization, abnormal, 455.
 magnetoresistance at low & high temps.,
 137, 198.
 monochromatic $K\alpha$ radiation, 100.
 nucleus, mech. moment, 455.
- Cobalt,**
 polished surfaces, structure, 590.
 powder, adsorption of hydrogen, ethane,
 & ethylene, 502.
 separation. See *Analysis*.
 solubility of oxygen, 555, 656.
 statistics, 734.
 thermal expansion, x-ray detn., 202.
 transformation point, 555, 656.
 transformations, heat-effects, 454.
 volatilization through chloride, 502.
- Cobalt alloys.** See *Alloys*.
- Coercive force.** See *Alloys & under names of metals*.
- Cohesion**
 in metallic crystals, 46.
 relation to plasticity, 175, 533.
- Cohesive force,** 562.
- Coinage** (see also *Alloys*),
 ancient Armorian & Gaulish, examin-
 ation, 739.
- Coke-handling equipment,** abrasion-resis-
 tant, 264.
- Cold-pressing.** See *Pressing*.
- Cold-shortness,** 369.
- Cold-work,**
 depth, x-ray measurement, 248.
 recovery of metals from, *review*, 142.
- Cold-worked metals & alloys** (see also
Alloys & under names of metals),
 impact torsion tests, 356.
 recovery, effect of heating time, 369.
 x-ray line sharpness, relation to high-
 temp. stability, 16.
- Cold-working** (see also under names of
 processes),
 effect of diamagnetism of metals, 565.
 lattice recovery after, x-ray study, 57.
 principles, 396.
- Colloidalization of metals,** 565.
- Coloured metals,** book, 546.
- Colouring,**
 black finish, 312, 447.
 book, 326 (*review*).
 electrolytic, 702.
 of small articles, 634.
 preparation for, 118.
 with molybdate solutions, 361; patents,
 361.
- Colouring of—**
 Aluminium, 32, 312, 361, 726; critical
 review, 119; oxide films, 539.
 Aluminium alloys, critical review, 119.
 Brasses, 183, 312; black finish, 312, 634.
 Bronzes, 183.
 Cadmium, 32.
 Copper, 32, 183, 312; black finish, 312;
 brown tones, 32.
 Copper alloys, brown tones, 32.
 Gold, 312.
 Iron, 312.
 Nickel, 312.
 Zinc, 32, 312; black finish, 237.
- Columbium.** See *Niobium*.
- Compounds,** intermetallic. See *Alloys*.
- Compressibility** (see also under names of
 metals),
 coefficients, detn., 532.
 of single crystals, 666.
 up to 5000 kg./cm.², 416.

- Compression.**
 strains, effect on strength of metals, book, 491.
 testing. See *Testing & Testing machines*.
- Concentrates,** mounting, for micro-examination, 343.
- Condensed metals,** fluorescence of salts surface-activated by, 666.
- Condenser tubes** (see also *Alloys*),
 cleaning, 605.
 corrosion. See *Corrosion*.
 materials, 79.
- Conductivity,**
 electrical. See *Electrical conductivity*.
 semi-. See *Semi-conductivity*.
 super-. See *Superconductivity*.
 theory, review, 513.
 thermal. See *Thermal conductivity*.
- Conductors.** See *Cables*.
- Consistency,** definition of term, 110.
- Constantan.** See *Alloys*.
- Contacts,**
 electrical, keeping clean, 488; with thin metal foil, 312.
 sliding, voltage drop, 93.
- Contraction.** See *Volume changes*.
- Copper,**
 absorption of oxygen, review, 665.
 action of nitrogen, 209.
 action on yeast, 124, 316, 640.
 adsorption of carbon monoxide, 656.
 adsorption of hydrogen, 656, 665.
 analysis. See *Analysis*.
 ancient smelting, 127.
 annealing. See *Annealing*.
 arc, temp., 176.
 arsenical, properties, 572.
 bibliography, 734.
 bismuth in, 106.
 books, 128, 547.
 brazing. See *Brazing*.
 cables, breaking length, 186; in Boulder Dam (U.S.A.) project, 316; loading tables, 541.
 casting. See *Casting*.
 casting skin, removal from rolling bars, 535.
 castings, elect. conductivity, 555; sp. gr., 555.
 cementation. See *Cementation*.
 chromium-plated, uses, 316.
 cleaning. See *Cleaning*.
 cohesive forces, quantum mech. investigation, 556.
 cold-drawn wire, vibration endurance strength, 199.
 cold-work, recovery from, review, 142.
 cold-worked, effect of silver on softening, 96; x-ray line sharpness, relation to high-temp. stability, 16.
 colouring. See *Colouring*.
 compressibility, 416.
 conductors, steel-cored, pamphlet, 269.
 contamination of foods, 543.
 corrosion. See *Corrosion*.
 corrosion-fatigue. See *Corrosion-fatigue*.
 crude, treatment, 441.
 crystallization, 586.
 cuprous oxide films on, 159; orientation, 687.
- Copper,**
 cuprous oxide in, planimetric detn., 42.
 cylinder heads, 124.
 data, booklet, 546.
 deformation resulting from heat-treatment, 461.
 deformation texture, review, 224.
 dendritic structure, 586.
 deoxidation. See *Deoxidation*.
 deposition. See *Deposition*.
 deposits, structure, relation to chem. & phys. properties, 469, 683.
 detection. See *Analysis*.
 diffusion of hydrogen, 139, 563, 665.
 diffusion of positive ions of salts at high temps., 556.
 diffusion of zinc, 90.
 drilling. See *Drilling*.
 dye kettles, 738.
 dynamic rupturing tests, 715.
 effect of arsenic, 572.
 effect of bismuth, 572.
 effect of oxygen, 42; see also *Alloys*:
 Copper-oxygen system.
 effect of ozone, 19.
 effect of reducing gases, 42.
 effect of sulphur, 455.
 elastic limit in torsion, 656.
 elastic properties of wire, effect of residual deformations, 90.
 electrical resistance at low temps., 200.
 electrode potentials in liquid ammonia, 704.
 electrolytic, specifications, 262.
 electron diffraction patterns, 225, 591.
 electronic structure, 467.
 elongation values, 27.
 embrittlement, 42, 89.
 enamelling. See *Enamelling*.
 entropy, 564.
 estimation. See *Analysis*.
 fatigue, effect of atmospheric action, 383.
 films, electron diffraction patterns, 225, 591; sputtered, optical properties, 200; sputtered, threshold value, 564; transparency in ultra-violet 276.
 fuse wire, melting time, 644.
 gases in, 716.
 grain-size, effect of annealing, 380.
 hardness, effect of cold-rolling, 2, 86; effect of temp., 619.
 heat of relaxation, from recrystn. data, 563.
 heat-treatment. See *Heat-treatment*.
 history, 37, 80.
 hot-working, 181.
 in air-conditioning plant, 487.
 in architecture & building, 126, 128, 319, 542, 640.
 in brewery, 640, 738.
 in chemical plant, 845.
 in coinage, 641.
 in domestic water services, pamphlet, 319.
 in food industries, 734.
 industry in 1935, 127.
 ingots, sound, for density detn., 208.
 lacquering. See *Lacquering*.
 lead-coated, in buildings, 316.

Copper,

- loco. fire-box plates, gas-welded, radio-logy, 111; manuf., 74; repair, 728.
- magnetic susceptibility, change, 460; relation to elastic stress, 138, 200.
- mechanical properties at low temps., 422, 501.
- medals, manuf., history, 187.
- melting. See *Melting*.
- mesh, uses, 316.
- metabolism, 640.
- metallographic etching, 682.
- metallurgy, advances, 80, 734.
- mosaic structure, 586.
- native, crystal structure, 423.
- odour, 48.
- oxidation, surface, 294, 515.
- oxide films, 102.
- oxide films on, structure, 590.
- parachor, 564.
- patina, artificial, prodn., 259, 361; rapid development after assembly, 182.
- photoelectric thresholds in turned state, 93.
- pipes, for gas services, 641; for water services, 518, 734; in gas-heated hot-water systems, 734.
- plastic flow, effect of fluid pressure, 335.
- plastic properties, in torsion, 656; of wire, effect of residual deformations, 90.
- polished surfaces, structure, 590.
- polishing. See *Polishing*.
- powders, adsorption of gases, 556; adsorption of hydrogen, ethane, & ethylene, 502; grinding apparatus, 556; lattice distortion, 592, 686; pressed, elect. conductivity, 6; pressed, hardening effects, 6; prodn., 641.
- protective films, formation, 159.
- refining. See *Refining*.
- reflection coefficient in spectral region 300-186 μ , 564.
- rolling. See *Rolling*.
- rolling texture, 100, 686.
- roofing, 734; "Cabra" patina treatment, 316.
- scrap, reworking, 72.
- separation. See *Analysis*.
- sheet, direct electrolytic prodn., 433; for building, handbook, 37; in buildings, 734; use against ants in tropics, 403; use for surveying plans, 188.
- silver-free, prepn., 477.
- single crystals. See *Single crystals*.
- smelting, primitive, 127.
- soldering. See *Soldering*.
- solid viscosity, 336.
- specific heat, true, 370.
- spraying. See *Spraying*.
- stannic oxide in, reduction by hydrogen, 365.
- statistics, 734.
- "stools" for ingot metals, 487.
- strain figure, formation, 89.
- strip, bars, & rods for elect. purposes, Brit. standard specifications, 487.
- substitutes, 37.

Copper,

- surface film, thickness, 657.
- switch contacts, life, 641.
- taste, 48.
- test-pieces broken dynamically, x-ray study, 685.
- thermal conductivity, effect of cold-work, 277.
- thermal expansion, 43.
- tin coatings, striations, 520.
- torsion diagrams, 356; tests, 273.
- total expansion from 75° to 1356° K., 199.
- toxicity, 36.
- tubes, for domestic purposes, 487; for gas service, 187; heat transfer & pressure drop data for oil, 542; hydraulic tests, 153; joints, 37; tensile properties, 153.
- vapour pressure, 209.
- volatilization through chloride, 502.
- welding. See *Welding*.
- wire rope, manuf., 446.
- wires, alternate bend strength, 438; cold-drawn, vibration endurance strength, 199; crystal orientation, effect of method of working, 16; crystal re-orientation on heating, 15; drawing. See *Wire-drawing*; elastic properties, effect of residual deformations, 90; hard-drawn, with preferred orientation, correlation of tensile strength, & elect. conductivity, 657; manuf., 725; plastic properties, effect of residual deformation, 90; substitution of zinc for tin in coating, 431; trolley, 187; trolley, wear & fatigue, 641; value of bend test, 725.
- Copper alloys. See *Alloys*.
- Coppersmith, book, 134 (review).
- Coppersmith's waste, treatment, 114, 252.
- Cores,
 - aluminium-coating, 625.
 - chaplets, calculation of size, &c., 178.
 - drying, 308, 394, 718.
 - effect of humidity, 178.
 - green-sand, 72.
 - metal-spraying, 233.
 - sands. See *Refractory materials*.
 - use of broken castings as, 252.
- Corn, processing, corrosion in. See *Corrosion*.
- Corrix. See *Alloys*.
- Corrosion (see also *Oxidation*, &c.),
 - and voltaic couples, 430.
 - application of statistical principles, 163.
 - atmospheric, 17, 151, 228, 429, 516, 674.
 - below discontinuous oxide coatings, 691.
 - bibliography of text-books, 39.
 - books, 38, 410, 489.
 - by acetic acid, 58.
 - by acids, 1, 17, 102, 161, 226, 471, 659, 691, 692; inhibitors, 519; localization of restraining action of surface-active substances, 230.
 - by ammoniacal cupric solution, 59.
 - by asbestos, 516.
 - by bleaching agents, 515.
 - by brines, 58, 294, 384, 598.
 - by butter, 102.

Corrosion,

- by calcium chlorate liquors, 59.
- by cements, 596, 690.
- by cheese, 293.
- by cherries, 161.
- by citric acid, 102, 688, 691.
- by cleansing agents, reduction, 692.
- by condensed milk, 316.
- by cream, 102.
- by dinitroglycol, 227.
- by electric glow discharges, 519.
- by foods, 102.
- by fruits & fruit extracts, 597, 689, 692.
- by gases at high temps., methods of study, 103.
- by hydrochloric acid solutions, 226.
- by hydrogen sulphide, 226.
- by kainite solutions, 162.
- by lactic acid, 102.
- by langbeinite solutions, 162.
- by linseed oil, 17.
- by liquid fuels, 228.
- by milk, 228, 384, 517, 519, 693.
- by mortar, 294.
- by nitric acid, 58.
- by nitrocellulose solutions, 60, 228.
- by nitroglycerin, 227.
- by nitrose, 596.
- by oxalic acid, 102.
- by petrols, 228, 295, 296, 518.
- by phosphoric acid, 598, 693.
- by pit-water, 472.
- by products of combustion of coal-gas, 693.
- by red beechwood, 345.
- by salt solutions, 691.
- by sea-water, 228, 230, 347, 595; action of lower forms of life, 430; protection by benzylcellulose lacquer, 430.
- by soda, 381.
- by soft water, effect of lime hydrate, 518, 693.
- by soils, 84, 102, 229, 596, 690.
- by stray currents, 229, 599; ammeter for observation, 695.
- by succinic acid, 102.
- by sulphur vapours, 226.
- by sulphuric acid, 382, 516, 690.
- by sylvinite solutions, 162.
- by tap-water, 690.
- by tartaric acid, 102.
- by tomato products, 517.
- by varnish acids, 519.
- by warm water, 430.
- by washing agents, 515.
- by wine, 102, 644.
- by woods, 160, 345, 596, 690.
- by zinc chloride-treated wood, 160.
- causes, 599.
- chemical, book, 410.
- chemical properties and, 430.
- Commission Aeronautique pour l'Etude de la Corrosion, reports, 158.
- electrochemical, theories, review, 599; theory, 599.
- in brewery, 292.
- in cellulose plant, 595.
- in chemical plant, 58, 61, 226.
- in condensed milk plant, 162, 317, 384.

Corrosion,

- in corn processing, 517.
 - in dairy, 645.
 - in dye industry, 295.
 - in food industry, 162, 517.
 - in ice-making plant, 103.
 - in oil industry, prevention by metal spraying, 603; reduction by selection of materials, 693.
 - in oil refineries, tables of data, 598.
 - in petroleum industry, 162.
 - in potash industry, 162.
 - in rayon industry, 690.
 - in sugar factory, 227, 295, 598.
 - in tomato products processing, 517.
 - intercrystalline, study by luminous diffusion, 471.
 - measurement, method, 230.
 - mechanism, 694; review, 103.
 - motor-electrolytic current as factor, 163, 430.
 - mutual displacement of metals, 694.
 - origin with oxygen depolarization, 599.
 - prevention, by lubricants, 386; by rubber coatings, 605.
 - probability, 694.
 - protection against, 20, 61, 103, 163, 231, 296, 348, 385, 430, 472, 519, 599, 695; book, 325 (*review*); by derived electrolytic action, 232; see also under various methods, e.g. *Anodic oxidation, Deposition, Galvanizing, Painting, Spraying, Tinning, &c.*, and under *Alloys* & names of metals.
 - rate, factors influencing, 163.
 - reports, of Corrosion Cttee. of Iron & Steel Inst., &c., 268; of 1934 German conference, 495 (*review*); of Swiss cttee., 384.
 - research, at Chem. Res. Lab., Teddington, 599; errors, 518, 694.
 - reviews, 231, 694.
 - surfaces, light diffusion, 60.
 - tarnishing, measurement, 19.
 - testing, effect of dimensions, form and surface state of specimens, 230; effect of method of immersion of specimens, 103; in sea-water, standardization, 158; methods, 60, 158, 347, 599, 694, 695; new method, 60; prepn. of artificial sea-water, 230; prepn. of sheet test-pieces, 163; review, 103; standardization of results, 430.
 - theories, 163, 229, 599; review, 519.
 - topochemical viewpoint, 519.
 - under cyclic stress. See *Corrosion-fatigue*.
 - voltic cells &, 163.
- Corrosion of—**
- Air-conditioning plant, control, 347, 693.
 - Albondur in North Sea, 595.
 - Alclad, effect of protective coatings, 164.
 - Aldrey wires round steel core, 159.
 - Allegheby metal by milk, 517.
 - Alloys by phosphoric acid, 693.
 - Alumag by sea-water, 230.
 - Aluminium, by acetic acid, 58; by acids, 226; by acids, effect of purity, 1; by alkalis, effect of addn. agents, 159; by boiling acids, 17; by boiling

Corrosion of—

Aluminium,

linseed oil, 17; by brines, 58, 294, 384, 598; by citric acid, 688; by fruit extracts, 689; by hydrogen sulphide, 226; by nitric acid, 58; by nitrocellulose solns., 60, 228; by products of combustion of coal-gas, 693; by soda, 381; by sulphur vapours, 226; by tomato products, 517; conductors, prevention by greasing, 386; effect of heat treatment, 226; effect of surface treatments, 61; electrochem. properties &, 58; hopper cars by high-sulphur coal, 292; in brewing industry, 292; in chem. plant, 58, 226; in hydrogen peroxide bleaching process, 17; in North Sea, 595; in sodium nitrate-potassium chloride soln., 598; negative difference effect, 292; rapid testing, 291; rapid tests, effect of sodium chloride & hydrogen peroxide concn., 381; reflectivity measurements to study progress, 159; review, 689; sheet, atmospheric, 17; test methods, 159.

Aluminium 3 S by milk, 517.

Aluminium alloys, by boiling linseed oil, 17; by water, prevention, 20; die-castings, effect of compn., 212, 337, 671; effect of surface treatments, 61; in North Sea, 595; microscopic study, 58, 381; rapid testing, 291; review, 689; structural, 427; test methods, 159; (wrought), 428.

Aluminium-bronzes, 227, 338.

Aluminium-copper alloys, effect of age-hardening, 381, 595; microscopic study, 58, 381; screen wire cloth, atmospheric, 429.

Aluminium-magnesium alloys, effect of heat-treatment, 471; effect of protective coatings, 164.

Aluminium-plate by acid solns., 161.

Aluminium-silicon alloys, effect of compn., 212, 337, 671.

Aluminium-zinc alloys, 228; microscopic study, 58, 381.

Antimony-lead alloys, by phosphoric acid, 693; water pipes, 516.

Antimony-magnesium-tin alloys, 470.

Antimony-magnesium-zinc alloys, 470.

Antimony-tin alloy, atmospheric, 516.

Barronia by acids, 161.

Beryllium, electrochem. properties and, 58.

Beryllium-copper alloys, 673.

Brasses, by brines, 294, 384; by cream & butter fat, 102; by 10% hydrochloric acid, 519; by liquid fuels, 228; by milk, 384; by products of combustion of coal-gas, 693; by 5% sodium chloride, 519; dezincification, 160, 690; fastenings in zinc chloride-treated wood, 160; in corn processing, 517; in hot-water systems, 596; in oil refineries, 598; pipes by water, 17; tubes, 160; wire, effect of exposure on breaking load, 383.

Corrosion of—

Bronzes, by brines, 384; by nitrocellulose solns., 60, 228; by pit-water, 472; by tomato products, 517; condenser tubes in gas condensers, 160; in cellulose boilers, 595; in condensed milk plant, 162; in corn processing, 517; in oil refineries, 598; wire, effect of exposure on breaking load, 383.

Cable-sheaths, 597; by stray currents, ammeter for observation, 695; electrolytic, 59, 229, 345, 382; electrolytic, detn., 345.

Cadmium, by organic acids, 102; electrodeposits, 297; electrodeposits, by volatile varnish acids, 519.

Cadmium-copper alloys, wires, effect of atm. exposure on breaking load, 383.

Cadmium-magnesium-tin alloys, 470.

Cadmium-magnesium-zinc alloys, 470.

Cadmium-zinc alloys, electrodeposits, 299.

Cartridge cases by dinitroglycol & nitroglycerine, 227.

Chromium, deposits, atmospheric, accelerated tests, 20, 86, 104; deposits by products of combustion of coal-gas, 693.

Chromium-nickel alloys, in sulphuric acid plant, 80; resistance wound on steatite insulator, 428.

Condenser tubes, by oil drops, 162, 346; electrolytic, 596; review, 160.

Constantan wires in heating pads, 429.

Copper, 227, 427; (arsenical), wire, effect of atm. exposure on breaking load, 383; basic copper carbonate & green patina, 345, 382; booklet, 128; by acid solns., 161; by ammoniacal cupric solns., effect of fluid velocity on solution velocity, 59; by brines, 294, 384, 598; by calcium chlorate liquors, 59; by copper salt solns., 159; by cream & butter fat, 102; by liquid fuels, 228; by milk, 517; by nitrocellulose solns., 60, 228; by sulphuric acids, 690; by tap-water, 690; by tomato products, 517; by washing & bleaching agents, 515; in condensed milk plant, 162, 317; in corn processing, 517; in heating & hot-water installations, 228; in hot-water systems, 596; in oil refineries, 598; in sodium nitrate-potassium chloride soln., 598; in tanning, 734; pipes by water, 17; screen wire cloth, atmospheric, 429; wires by elect. glow discharge, 519; wires (H.C.), effect of atm. exposure on breaking load, 383.

Copper alloys, 227, 690; by acids, 471; in dye industry, 295; in gas appliances, 599.

Copper-gold alloys, solid solns., mechanism, 293.

Copper-nickel alloys, 227; by washing & bleaching agents, 515; screen wire cloth, atmospheric, 429; tubes in sugar factory, 227; wire, effect of atm. exposure on breaking load, 383.

Corrosion of—

Copper-nickel-tin alloys, effect of pptn.-hardening, 345.

Copper-nickel-zinc alloy, screen wire cloth, atmospheric, 429.

Copper-silicon alloy, wires, effect of atm. exposure on breaking load, 383.

Copper tin alloys, atmospheric, 516; screen wire cloth, atmospheric, 429.

Copper-zinc alloy screen wire cloth, atmospheric, 429.

Cuprite pipes by water, 17.

Duralplat, 514; effect of heat-treatment, 514.

Duralumin, 514; by milk, 384; effect of protective coatings, 164; in salt solns., accelerated test methods, 159; method of test, 158; reflectivity measurements to study progress, 159.

Electrodeposits, 162, 294; on zinc alloy die-castings, 238.

Elektron in contact with other metals, 428.

Galvanized iron & steel, 293; by brines, 294; in hot-water systems, 596; in zinc chloride-treated wood, 160; pipes by water, 17; wire, effect of atm. exposure on breaking load, 383.

Heating installations, 228.

Hot-water apparatus, 20, 596.

Hydronalium in North Sea, 595.

Hytenzyl bronze by phosphoric acid, 693.

Inconel, 227, 346; by milk, 517; by phosphoric acid, 693; in condensed milk plant, 162.

Iron, by acid solns., 161; by brines, 294, 384; by calcium chlorate liquors, 59; by cream & butter fats, 102; by nitrocellulose solns., 60, 228; by products of combustion of coal-gas, 693; in cellulose boilers, 595; in dye industry, 295; in hot-water systems, 596; in sodium nitrate-potassium chloride soln., 598; pipes by water, 17.

Iron alloys by phosphoric acid, 693.

Iron-nickel alloys (electrodeposited), 516.

Joints (metal-to-metal), 520.

K.S.-Seewasser in North Sea, 595.

Lautal, effect of surface treatments, 61.

Lead, 227; by acids, 691; by brines, 294, 384; by calcium chlorate liquors, 59; by cement, 596, 690; by liquid fuels, 228; by mortar, 690; by nitrocellulose solns., 60, 228; by nitroze, 596; by phosphoric acid, 693; by products of combustion of coal-gas, 693; by soils, 596, 690; by tap-water, 690; by wood, 596, 690; cable-sheaths, 597; cable-sheath, electrolytic, 59, 345, 382; cable-sheath, electrolytic, method of detn., 345; effect of arsenic, 507; in buildings, prevention, 545, 596, 648; in heating & hot-water installations, 228; in sulphuric acid, effect of external factors, 382, 516; in sulphuric acid plant, 59, 80, 596; pipes by mortar, 294; pipes by water, 515; pipes in water services, 293; study of oxide films, 59.

Corrosion of—

Lead-magnesium-tin alloys, 470.

Magnesium, 346; below discontinuous oxide coatings, 691; by acids, 659; effect of manganese, 60, 346, 691; electrochem. properties and, 58; negative difference effect, 292.

Magnesium alloys, 227; bibliography, 427; binary, effect of addns., 470; by aqueous salt solns., 293; (cast), 427; (cast), effect of heat-treatment, 427; in contact with other metals, 428; rolled, book, 544, 648; (ternary), 470.

Magnesium-tin-zinc alloys, 470.

Magnesium-zinc alloys, effect of heat-treatment, 471.

Monel metal, by foods, 102; by pit-water, 472; by tomato products, 517; in condensed milk plant, 162; in corn processing, 517; in oil refineries, 598.

Natural gas transmission lines, internal, 61.

Nickel, 227; by asbestos, 516; by brines, 294; by cream & butter fat, 102; by foods, 102; by milk, 384, 517; by tomato products, 517; by washing & bleaching agents, 515; deposits, atmospheric, accelerated tests, 20, 86, 104; deposits by products of combustion of coal-gas, 693; deposits by volatile varnish acids, 519; in condensed milk plant, 162, 317; in corn processing, 517; wire, effect of atm. exposure on breaking load, 383; wires in heating pads, 429.

Nickel alloys, by acids, 471; by asbestos, 516; by milk, 384.

Nickel-brasses, 227; atmospheric, 151, 674; in corn processing, 517.

Nimol by pit-water, 472.

Ni-Resist by pit-water, 472.

Oil production equipment, 518.

Pantal in North Sea, 595.

Pewter, 178.

Phosphor-bronze, 177.

Pipes for water services, 518.

Plumrite pipes by water, 17.

Screen wire cloth, atmospheric, 429, 549.

Sheet, prepn. of test-pieces, 163.

Silicon-bronzes, comparative study, 690.

Silumin, effect of surface treatments, 61.

Silver, prevention of tarnishing, 296; (tarnishing), 102.

Solders, by brines, 384; by products of combustion of coal-gas, 693; in condensed milk plant, 162; in corn processing, 517.

Solid solutions, mechanism, x-ray study, 293.

Sprayed metal coatings by alkaline liquors, 602.

Steels, 518; by brines, 295, 598; by fruit extracts, 692; by nitrocellulose solns., 60, 228; by phosphoric acid, 693; in cellulose boilers, 595; in dye industry, 295; in oil refineries, 598; in sodium nitrate-potassium chloride soln., 598; pipes by water, 17.

Corrosion of—

Tin, atmospheric, 516; by aqueous ferric chloride, 691; by citric acid, 691; by cleaning agents, reduction, 692; by liquid fuels, 228; by nitrocellulose solns., 60, 228; by products of combustion of coal-gas, 693; by tap-water, 690; by tomato products, 517; foil by cheese, 293; in condensed milk plant, 162; in corn processing, 517; study of oxide films, 59.

Tin-antimony-copper alloys, 18.

Tinned copper by brines, 294.

Tinned iron, by milk, 228; cans by food, 102.

Tinned sheets by brines, 384.

Tinned ware, black spots, 471, 544.

Tinplate, 227; bibliography, 517; black spots, 471, 544; by acid solns., 161; by cherries, 161; by cleaning agents, reduction, 692; by foods, 161; by fruits, 161, 597, 692; in food industry, 517, 648; inhibiting properties of English beet sugars, 692.

Tubes, 518.

Type metal in contact with red beech-wood, 345.

Underground pipes, by soils, 229; electrolytic, 229.

Welds, 19.

Wires in heating pads, 429.

Zinc, 517; anodes in acid solns., 162, 429; by brines, 384, 598; by distilled water, 60; by milk, 384; by nitrocellulose solns., 60, 228; by products of combustion of coal-gas, 693; by tap-water, 690; effect of purity, 346; electrodeposits, 297; in corn processing, 517; in presence of oxidizing agents, 597; in various electrolytes, book, 131; rate, anomalies, 228; rotating cylinders by acids, 692; sheet in contact with brick, 294; wire, effect of atm. exposure on breaking load, 383.

Zinc alloys, 228; comparative tests, 152.

Corrosion-fatigue, bibliography, 229.

Corrosion-fatigue of—

Aldrey transmission lines, 159.

Alloys, tables of results, 229.

Aluminium transmission lines, 159.

Copper transmission lines, 159.

Duralumin, 158; with & without protective coatings, 381.

Corrosion-resistant materials (see also *Alloys & under names of metals*),

book, 272 (review).

classification, 694.

for chemical plant, 79.

for gas appliances, 599.

for oil industry, 693.

for oil-refinery pumps, 347.

for textile equipment, 346.

history, 348.

list, 163.

review, 694.

selection, 694.

trade names, 694.

Corundum. See *Refractory materials*.

Cracking. See *Internal stress*, *Season-cracking*, &c.

Cream, action on metals. See *Corrosion*.

Creep (see also *Alloys & under names of metals*),

abnormal, during transformation, 336, 671.

and elastic recovery phenomena, 47.

bibliography, 665.

comparative studies, 93.

effect of grain-size, 154.

factors influencing, 276.

long-time test data, use in design of heat-resistant castings, 70.

process, 335.

relation of age-hardening, 673.

reviews, 142, 665.

testing. See *Testing*, & *Testing machines*.

under stresses produced by pure flexure, 664.

Crucibles. See *Refractory materials*.

Crystal lattice (see also *Crystal structure*, *Alloys*, & under names of metals),

binding forces, 289.

body-centred cubic, transition to close-packed hexagonal, 16.

constants, detn. by electron diffraction, 223; differences, 594.

cubic face-centred, 688.

distortion, 592, 686, 687; effect on diffusion, 588, 685; x-ray study, review, 595.

energy, relation to latent heat of vaporization, 46.

parameters, precision measurement, 101.

transformation from face-centred cubic to body-centred cubic, mechanism, 101, 514.

types, table, 513.

Crystal structure (see also *Crystal lattice*, *Alloys*, & under names of metals),

above melting point, 588.

as affecting properties of materials, 225.

at high temperatures, apparatus for study, 592.

bibliography of text-books, 39.

Bitter's patterns, 595.

books, 272 (review), 549, 741 (review).

Debye-Scherrer photographs, reproduction, 380.

investigation, apparatus. See *Laboratory apparatus*; recent methods, 514.

of AB₃-type compounds, 157.

of alloys, theory, 379.

of transition & uni-valent metals, effect of electron configuration, 594.

relations, book, 87 (review).

review, 513; of investigations in 1930-1932, 513.

space-filling of molecules, model, 467.

special problems, solution of, use of long-wave x-rays, 101.

superlattices, statistical theory, 425.

tables, 492, 513, 546.

theories, 379.

vacant lattice points, 687.

Weissenberg photographs, interpretation, 380.

Weissenberg reciprocal lattice projection 101, 380.

- Crystal structure**,
 with many parameters, detn., 101.
x-ray analysis, 157, 225; book, 87
 (*review*); doubled method, 688;
 identity period, chamber for detn.,
 713; intensity of reflection, quant.
 measurement, 467; powder & rotating
 crystal methods, absorption factor,
 467.
x-ray diagrams, apparatus to compare,
 713.
x-ray powder patterns, precision photo-
 graphy, 617; technique, 712.
Crystallization (see also *Alloys* & under
 names of metals),
 book, 191.
 electro-, 220.
 from sparse assemblages, 54, 683.
 kinetics, 423.
 linear rate, theory, 220.
 of alloys, 683.
 of eutectics, 470, 511.
 of ingots, 683.
 primary, 223.
Crystallography, x-ray, indust. appns., 344.
Crystals (see also *Alloys* & under names of
 metals),
 block structure, 344.
 cathode ray reflection, 591.
 classification, 688.
 Debye-Waller function, 222.
 deformed, change in intensity of x-ray
 reflection, 425; detn. of axis of
 bending from Laue photos., 379;
 Laue diagrams, 425.
 dendritic structure, 586.
 distortion, book, 87 (*review*); residual,
 detection & evaluation, 379.
 elastic moduli, calculation, 47.
 elasticity, Cauchy's relations, 290.
 electron diffraction, 591.
 ferromagnetism, 144.
 flaws, 344.
 flow, 413.
 galvanomagnetic phenomena, theory,
 668.
 group phenomena, 290.
 growth, 423, 587; homopolar, 15;
 theory, 587; see also *Recrystallization*,
 &c.
 identification by x-ray diffraction pat-
 terns, 426.
 imperfections, 291.
 inner potentials & electron diffraction,
 289.
 interatomic distances, detn., 380.
 investigations, modes of attack, 16.
 lattice constants. See *Crystal lattice*.
 line structure, 225.
 metallic, cohesion, 46; distortion, book,
 87 (*review*); electronic functions, 57.
 mosaic structure, 586, 688; secondary,
 344; theories, 225.
 nuclei, prodn., 423.
 orientation, detn. by back-reflection
 Laue photographs, 157, 688; detn.
 under microscope, 617; effect on
 soly., 423; Leonhardt's method, appn.
 to depn. of phosphor-nickel in Kam-
 acite, 514; simple detn., 426.
- Crystals**,
 perfect, x-ray diffraction, simplification
 of Prins' formula, 158.
 physical properties, limitations imposed
 by symmetry, 595.
 plastic deformation. See *Plastic deforma-*
tion.
 plasticity, 273, 290, 664; book, 323
 (*review*); effect of temp., 562;
 theories, 335, 594.
 preferred orientations in worked cubic
 metals, analyt. detn., 379.
 quasi-isotropic, multiple, calculation of
 phys. constants, 208; multiple, elastic
 properties, 208.
 real, deviations from ideal lattice struc-
 ture, 291; theory, 344.
 refractive index for cathode rays, 380.
 residual distortion, evaluation, 224.
 rupture, 291, 664.
 secondary structure, 226.
 single. See *Single crystals*.
 slip bands, x-ray study, 289.
 specific heat, theory, 143.
 strain-hardening, 290.
 strength, 664.
 structural classification, 16.
 structure, mech. properties &, 344.
 structure factors, computation, 380.
 sub-microscopic, shape, 224.
 symmetry, limitations on phys. proper-
 ties, 595.
 twinning, 221, 684, 685; at irrational
 surfaces, 685; kinetics, 685; planes,
 nature, 344.
 two-dimensional, interference phenom-
 ena, 380.
 very thin, growth, 587.
 x-ray reflection, temp. function, 100.
 x-ray rotation diagrams, graphical in-
 vestigation, 101.
- Cupellation losses**, reduction, 708.
Cuprite. See *Alloys*.
Cuprotectic. See *Welding, rods*.
Cuprous oxide. See *Alloys & compounds*.
Curie point (see also *Nickel, &c.*),
 displacement by tension, 565.
Cutting (see also *Machining* & under names
 of machining processes),
 abrasive-, 396.
 bibliography, 544.
 fluids, performance in sawing metals,
 75.
 gas-, book, 546.
 oxy-acetylene, pamphlet, 130.
 reference book, 327 (*review*).
Cutting of—
 Sheets, 483.
 Zinc sheets, 446.
Cutting tools,
 tungsten carbide, cemented, appns., 182.
 Widia, performance & life, 259.
Cyanide solutions, solubility of alloys, 18.
Cylinders,
 light metal, for propane gases, 732.
 thick, elastic failure, 6.
- D 2**. See *Alloys*.
DM 31. See *Alloys*.

- Dairy industry,**
materials for, 404, 645.
products, corrosion by. See *Corrosion*.
- Damping** by discs at high frequency,
book, 38.
- Debye-Scherrer diagrams.** See *Crystal structure*.
- Deep-drawing.** See *Drawing*.
- Defects,**
detection. See *Radiology*.
internal, revealing by ultra-acoustic vibrations, 479.
- Deformation** (see also *Alloys* & under names of metals),
as result of heat-treatment, 461.
elastic. See *Elastic deformation*.
mechanism, 47; model substances for elucidating, 142.
plastic. See *Plastic deformation*.
texture, x-ray analysis, review, 224;
see also *Rolling texture, Alloys, & under names of metals*.
- Degassing of—**
Brasses, 622, 623; bibliography, 623.
Bronzes, 622, 624; bibliography, 622.
Metals, method, 704, 705; symposium, 622, 623.
- Degreasing,**
baths, regeneration, 259.
methods, 259.
plants, 118.
- Demagnetization factor** of cylindrical rods, 567.
- Dember effect,** theory, 668.
- Dendrites,**
fineness, relation to grain-size, 585.
questionnaire, replies to, 423.
- Density** (see also *Alloys* & under names of metals),
of ingots, making sound ingots for determinations, 208.
- Dental alloys.** See *Alloys*.
- Deoxidation,** 534, 716.
bibliography, 534.
symposium, 622, 623.
- Deoxidation of—**
Brasses, 308, 622, 623; bibliography, 622.
Bronzes, 622, 624; bibliography, 622;
by phosphorus, 623; use of apatite ore, 70.
Copper, use of apatite-nephelinic ore, 70.
Copper alloys, 112.
Nickel-brasses, 151, 440, 674.
Silver, 481.
Zinc-bronzes, 481.
- Deoxidizers,** 534.
alkali metal, 308, 494, 622.
- Deposition (electro-),**
action of buffers, 168.
adherence of coatings, 302.
adsorption of hydrogen, review, 665.
barrel-, efficiency of horizontal barrel, 238; technique, 473;
baths, buffering, 527; effect of suspended matter, 238; evolution, 475.
books, 133 (*reviews*), 495 (*review*), 545, 652 (*review*).
cathode film control, 608, 702.
conveyor vats, mode of operation, 527.
- Deposition (electro-),**
current used, measurement, 302.
cyanide baths, 527; book, 652 (*review*).
cyanides, Brit. Stand. specifications, 528, 545.
developments, 169, 434.
electrode reactions, detection, 434.
electrolytes, Ostwald's law of dilution 302.
industry in 1935, 127.
mechanism, theories, 285.
moving cathode plant, 473.
on aluminium, 388, 434; review, 296.
on aluminium alloys, 1.
on magnesium alloys, 1.
on wires, test of coating, 238.
on zinc-base die-castings, 607.
patents, 64.
plant at Sheffield, 702.
preparatory processes, 106, 118.
research, 351, 475.
review, 168.
specifications, 106, 168, 527.
suspension, methods, 169.
throwing power, definition, 527; effect of shape of articles, 64; measurement, 302, 527.
with simultaneous scraping of anode & cathode, 351.
- Deposition (electro-) of—**
Aluminium, 21, 528; from fused salt-bath, 524.
Antimony, 528; on wire, calculated for cells, 389.
Arsenic, 528.
Bismuth, 387; from dilute solns., 609.
Brass, analysis of solns., 389; faults, 63; intermediate coats, 349; maintenance of cyanide solns., 63.
Cadmium, 299, 528; analysis of baths. See *Analysis*; barrel-, 524; book, 133 (*review*); detn. of thickness of deposit by drop test, 237, 527; detn. of thickness of deposit by Hull & Strausser test, pamphlet, 407; effect of various factors, 235; factors affecting structure & grain-size of deposit, 285, 470; in elect. engineering, 165, 524; on steel, specifications, 349; specifications, 527; structure of deposits, 592.
Cadmium-tin-zinc alloys, 235.
Cadmium-zinc alloys, from acid sulphate solns., 299, 434; from alkaline cyanide solns., 168.
Chromium, 473, 528, 605; analysis of baths. See *Analysis*; black deposits, 105, 299; books, 133 (*review*), 318, 650; deposits with high corrosion- & heat-resistance, 473; effect of bath concn. on hardness of deposit, 299; effect of bath temp. on hardness of deposit, 433; effect of Cr⁺⁺⁺ on hardness of deposits, 236; effect of conditions on porosity of deposits, 700; effect of current density on hardness of deposits, 62; effect of Fe on hardness of deposits, 236; effect of sulphate on hardness of deposits, 524; effect of temp., 62; effect of various factors,

Deposition (electro-) of—
Chromium.

235; from chromic acid baths, mechanism, 432; from chromic acid solns. contg. hydrofluoric acid, 165; methods, 236; on aluminium & its alloys, 166; on automobile bumpers, 301; on automobile parts, 528; on die-castings, 388; on pulp & paper screens, 700; on sheet zinc & zinc-base die-castings, 301; on steel, specifications, 168, 350; on zinc alloys, 606; operation, 62; peeling due to mech. strain, 238; principles, 105; removal of faulty plating, 62; specifications, 527; testing coating, 62; theory, 62, 235, 299, 350, 700; thickness of deposit, detn., 524; throwing power, detn., 524; use of porous pots to eliminate chromates in bath, 166.

Cobalt, alkaline baths with high throwing power, 21; defects, 605; from chloride soln. in mixture of water & ethyl alcohol, 526; review, 236.

Copper, 473; adherence of deposits, 237; analysis of baths. See *Analysis*; book, 133 (*review*); effect of adsorbed colloids on structure of deposits, 168; effect of basis metal on structure of deposit, 286, 470, 683; effect of shape of article on throwing power, 64; from acid solns., 21; from conc. cyanide solns., 63, 525, 700; from cyanide solns., causes of faults, 63; on aluminium contacts, 236; on iron at high c.d., 300; on steel, 700; on zinc-base die-castings, 606; on zinc-base die-castings, diffusion action, 237; review, 21; sheets, 433.

Copper-iron-nickel alloys, 63.

Copper-nickel-zinc alloys from cyanide baths, 300, 433.

Copper-tin alloys, 349.

Gold, 237; book, 133 (*review*); crystn. centres, 350; from fulminate baths, 300; on aluminium, 63; on wire, 605.

Iron-nickel alloys, 433, 526; effect of addns., 237.

Lead, from perchloric acid, 525; on wire, calculations for cells, 389.

Nickel, alkaline baths with high throwing power, 21; analysis of baths. See *Analysis*; and hydrogen from solns. of single salts, simultaneous discharge of nickel & hydrogen ions, 701; anodes, 350; at high c.d., structure & properties of deposit, 287, 343, 469, 683; automatic, 166; black deposits, 474; book, 133 (*review*); bright deposits, 167; bright-plating bath, 63; control, 300; defects, 64, 105, 525; developments, 105; ductility & adhesion of deposits, 301; economics, 606; effect of hydrogen peroxide and nickel nitrate, 22, 701; effect of inorganic addn. salts, 525, 701; effect of oxidizing agents, 606; effect of shape of article on throwing

Deposition (electro-) of—
Nickel.

power, 64; Fescol process, 166; from baths with pH values greater than 7.0, 166; from chloride soln. in mixture of water & ethyl alcohol, 526; heavy deposits, 166; heavy deposits, control by microscope, 167; in France, 166; on aluminium & its alloys, 22, 105, 166, 167; on automobile bumpers, 301; on automobile parts, 528; on die-castings, 388; on steel, specifications, 168, 350; on wires, thickness of deposit, detn. by Glazunov's method, 350; on zinc, multiple coat, 387; on zinc-base die-castings, 301, 606; on zinc sheet, 301; plant lay-out, 105; practical hints, 105; rapid, 64; review, 387; specifications, 527; testing of deposits, 701; thickness of deposit, detn., 524; throwing power, detn., 524; use of angled electrodes, 300; uses of nickel compds., 64; with low hydrogen content, 387.

Niobium, 701.

Platinum, 262.

Polonium from dilute solns., 609.

Rhenium, 237, 301.

Rhodium, 167, 301.

Silver, 473; analysis of baths. See *Analysis*; book, 133 (*review*); early, in U.S.A., 387; faulty deposits, 434; from iodide solns., 351; to specification, 351.

Tantalum, 701.

Tin, 388, 474, 606; analysis of baths. See *Analysis*; control of quality, 702; for refrigerating plant, 474; from alkaline baths, 237; from alkaline stannate baths, effect of addn. agents, 526, 702; on galvanized sheet iron, 474; on pistons, 526; on timplat, 702; on wire & sheet metal, 301.

Tin alloys from alkaline stannate baths, 606.

Tungsten, 528; from aqueous solns., effect of iron, 237.

Zinc, 474; analysis of baths. See *Analysis*; book, 133 (*review*); bright deposits, 301; comparison of baths, 301; detn. of thickness of deposit by drop test, 237, 527; detn. of thickness of deposit by Hull & Strauss test, pamphlet, 407; from ammonium sulphate solns., 167; from cyanide baths using Al-Hg-Zn anodes, 167, 434; from sulphate solns., effect of addns., 607; on steel, specifications, 351; on steel wire, continuous process, 301; on wire, 607; on wire, calculations for cells, 389; review, 298; simultaneous cathodic discharge, 607; specifications, 527; throwing power of zinc sulphate solns., 22.

Deposits (see also *Alloys* & under names of metals),

built-up surfaces, mech. treatment, 183.
cathodic in elect. reduction of aq. CrO_3 , 302, 475.

Deposits.

- electro-**, adhesion, 302; analysis. See *Analysis*; character, control, 22; corrosion. See *Corrosion*; form, relation of potential at cathode, 286, 470; microstructure, 105; protective values, 20, 21, 82; somatoid elements of structure, 469; structure, 343; structure, detn., 285, 469; structure, effect of adsorption of colloids, 168; structure, effect of basis metal, 286, 470, 683; structure, effect of film formation, 285, 469; structure, effect of support, 286, 470; structure, relation to chem. & phys. properties, 469, 683; structure, x-ray diffraction study, 288; testing, 168; thickness, detn., 303, 527.
- hot-dipped**, appn., 164.
- identification**, chem. methods, 610; electrographic, 611.
- protective value**, 599.
- stripping**, 303.
- structure**, 284, 285, 286, 287, 288, 468.
- testing**, 303; electrographic, 600.
- thickness**, detn., 348; detn., bibliography, 527.
- Dermatitis in industry**, 544.
- Descaling**, Bullard-Dunn process, 259.
- Desulphurization**, 716.
- Desulphurization of—**
Tin & its alloys, 441.
- Detection**. See *Analysis*.
- Deuterium**, diffusion through palladium, 559.
- Dezincification**. See *Corrosion*.
- Diamagnetic susceptibility**. See *Alloys & under names of metals*.
- Dictionaries (technical)**,
English-French, 85.
English-German, 331 (*review*).
English-Russian, 331 (*review*).
German, of tech. terms, 408.
German-English, 331 (*review*).
German-Russian, 129, 268, 331 (*review*).
- Die-casting**,
alloys for. See *Alloys*.
book, 325 (*review*).
developments, 308.
dies, 113; adjustable, 394, 536; complicated, 394; design, 252; steels for, 178.
gravity, 308.
limitations, 718.
machines, 30, 178, 251, 441, 536, 718; compression chambers, 71; for aluminium, 625.
pressure, 717; book, 189; in Russian works, 71.
reviews, 441, 625, 718.
- Die-casting of—**
Alloys, 717.
Aluminium, 74, 625.
Aluminium alloys, 71, 74, 113, 178, 251, 493.
Aluminium-bronze, 252, 394.
Brasses, 30, 113, 252, 358, 481, 718.
Copper alloys, review, 536.
Hubs & caps, 441.
Magnesium alloys, 251, 624.
Zinc alloys, 113.

Die-castings (see also *Alloys & under names of metals*),

- fettling, 183.
inspection, 355.
limitations, 718.
plating. See *Deposition*.
specifications, 644.
testing. See *Testing*.
- Diffraction of cathode rays by films**, detection, 27.
- Diffusion** (see also *Cementation & under names of metals*),
coefficient, study by evapn. method, 209.
in solid state, 55.
lattice distortion on, 588, 685.
of gases. See *Gases & under names of gases*.
- Dilatometers**. See *Laboratory apparatus*.
- Dinitroglycol**, action on metals. See *Corrosion*.
- Directional properties**, 55; see also *Alloys & under names of metals*.
- Dispersed phases**, production, apparatus, 564.
- Distortion of fabricated structures**, control, 540, 636.
- Double sheets**, manufacture & use, 104.
- Dowmetal**. See *Alloys*.
- Drawing**, 360.
book, 269.
deep-, general discussion, 630; metallurgical aspects, 630; of cylindrical shells, 630; relation between plastic deformation & tensile properties, 118, 723; tester. See *Testing machines*.
expressed in polar co-ordinates, 631.
tube-. See *Tube-drawing*.
wire-. See *Wire-drawing*.
- Drawing of—**
Aluminium, 74; deep-, 74; deep-, lubricants, 32.
Aluminium alloys, 74; deep-, 74, 118.
Brasses, book, 411 (*review*).
Tubes. See *Tube-drawing*.
Wire. See *Wire-drawing*.
- Drilling of—**
Aluminium, 75, 446.
Aluminium alloys, 75, 446.
Copper tube plates, 726.
Monel metal, 118, 633.
- Ductility**, testing. See *Testing*.
- Duralite**. See *Alloys*.
- Duralplat**,
bibliography, 520.
corrosion. See *Corrosion*.
development, 520.
manufacture, 520.
properties, 520.
- Duralumin**. See *Alloys*.
- Duraspray rust-proofing process**, 700.
- Dvi-manganese**. See *Rhenium*.
- Dyeing industry**,
liquors, corrosion by. See *Corrosion*.
materials for, 188.
- Dyes**, effect on metals, 738.
- Education**, technical, book, 407.
- Egypt**, ancient materials & industries, 130.

- Eka-tantalum**, chemistry, 141.
- Elastic deformation** (see also *Deformation*, *Alloys*, & under names of metals),
x-ray study, review, 595.
- Elastic limit** (see also *Alloys* & under names of metals),
nature, review of work on rock-salt, 142.
- Elastic properties.** See *Alloys* & under names of metals.
- Elastic recovery**, creep &, 47.
- Elastic strains**, investigation, 355.
- Elastic stresses**,
determination in micro-crystalline aggregates by Debye-Scherrer method, 57.
measurement, by x-rays, 480; reflected x-ray method, 248.
relation to magnetic susceptibility, 200.
- Elastic tests.** See *Testing*.
- Elasticity** (see also *Alloys* & under names of metals),
books, 85, 327 (review).
failure of thick cylinders, 6.
Hooke's law, extension, 6.
modulus, 439; deduction from frequency of longitudinal vibrations of rods, 667; detn., 26; detn., dynamic, 619; of regular metals, calculation, 47.
of ferromagnetic materials, Young's modulus, effect of magnetization, 565.
- Electric arc**,
furnaces. See *Furnaces*.
temperatures, measurements, 620.
welding. See *Welding*.
- Electric furnaces.** See *Furnaces*.
- Electric welding.** See *Welding*.
- Electrical conductivity** (see also *Electrical resistance*, *Alloys*, & under names of metals),
at low temperatures, 212.
effect of pressure, 143, 144.
effect of surface electron waves, 94, 279, 667.
of electrode system (metal-salt layer-adsorbed alkali metal), 277.
of films, 49, 210; in electrostatic field, 210; second effect of elect. charge, 210; temp. coeff., 49.
of powdered metals, 6.
theory, 144.
- Electrical contacts.** See *Contacts*.
- Electrical engineering**, non-ferrous metals in, 127.
- Electrical heating elements.** See *Alloys*.
- Electrical industry**,
development in 1934, 359.
directory (British), 266.
plant, non-ferrous metals in, economy, 80.
- Electrical properties** (see also *Alloys* & under names of metals),
book, 195 (review).
- Electrical resistance** (see also *Electrical conductivity*, *Alloys*, & under names of metals),
and thermoelectric force, 277.
at low temperatures, in magnetic field, 417.
change in magnetic field, 502.
during fusion, 370.
effect of direction of spontaneous magnetization, 211.
- Electrical resistance**,
effect of light, 416.
effect of non-harmonic thermal vibrations of atoms, 94, 211.
effect of pressure, 274, 666.
effect of temperature, 460.
of ferromagnetic materials, 502.
of molten metals, change in magnetic field, 668.
of thin films, effect of light, 48.
standards, pure metal, pamphlet, 86.
- Electrical resistance materials.** See *Alloys*.
- Electrically-heated slab**, temp. history & rate of heat loss, 254.
- Electrochemistry**,
books, 490, 648, 649, 741 (review).
principles, applied to electrodeposition, 302.
progress, 702.
- Electrodeposition.** See *Deposition*.
- Electrodeposits.** See *Deposits*.
- Electrode potentials** (see also under *Alloys* & names of metals),
in electrolytes of foreign ions, 528.
- Electrodes**,
alloy, for luminous discharge tubes, 737.
carbon, 719.
graphite, 719.
in vacuum, breakdown voltages, apparatus for measurement, 618.
metallic, arcs in air between, 23.
overvoltage. See *Overvoltage*.
passivity. See *Passivity*.
polarized, effect of H.-F. currents, 704.
- Electrolysis of—**
Rare earth metal salts, 239.
- Electrolytes**, conductance, mechanism, 351, 435.
- Electrolytic analysis.** See *Analysis*.
- Electrolytic deposition.** See *Deposition*.
- Electrolytic oxidation & reduction**, book, 741 (review).
- Electrolytic refining.** See *Refining*.
- Electrolytic valve action.** See under names of metals.
- Electromagnetic theory**, 94.
- Electrometallurgy**,
industries in State of Washington & Pacific N.W., economic possibilities, pamphlet, 129.
progress, 702.
- Electron (alloy).** See *Alloys: Elektron*.
- Electron-inertia effect**, theory, 668.
- Electron potential energy**, relation to exit work, 212.
- Electron theory.** See *Metallic state*.
- Electronic structure**, book, 195 (review).
- Electrons**,
conducting, detn. of magnitude of motion, 49.
conduction. See *Metallic state*.
diffraction, & inner potential of crystals, 289; apparatus. See *Laboratory apparatus*; appns., 380; as method of research, 224; by metal crystals & mica, 591; detn. of lattice const. by, 223; methods for studying surface structure, 289; one-dimensional, 157.
diffraction patterns, "extra" rings & bands in, 224, 591; of films, 225.

- Electrons,
 emission & absorption, book, 544.
 free, deduction of number, 568.
 functions in metals, 278.
 in industry, book, 269.
 in metals, interaction, 58.
 mean free path, 365, 367, 459, 568;
 direct detn., 143.
 secondary, emission, thermal theory of
 cathodic dispersion and, 101.
 slow, effect on metal surfaces, 277.
 transition from metal to dielectric, 49.
- Electroplating. See *Deposition*.
- Electrotechnology, books, 86, 491.
- Electrothermal homogeneous effect (see
 also under names of metals),
 effect of gas ions, 210.
- Elektron. See *Alloys*.
- Element 93,
 chemical properties, 666.
 reaction with element 91, 666.
- Element 94, chem. properties, 666.
- Elements,
 numerical relationships, book, 81.
 properties, book, 81.
 transformation, book, 490.
- Elongation. See *Tensile properties, Testing,*
 &c.
- Eloxal process. See *Anodic oxidation*.
- Emed-Alu-Strapazoid, 262.
- Enamelling,
 book, 545.
 faults, book, 39.
- Enamelling of—
 Copper & its alloys, 485.
 Galvanized iron, 522.
- Endurance bending strength at sockets,
 boss-heads, &c., 439.
- Endurance properties. See *Fatigue, Test-*
ing, Alloys, & under names of metals.
- Energy loss, measurement, 246.
- Engineering,
 materials, metallurgical survey, 14, 99;
 prodn. methods & equipment, 406.
 mechanical, book, 40 (*review*).
 research, at Nat. Phys. Lab., Teddington,
 740; in U.S.A., 647.
 year-book, 408.
- England. See *Great Britain*.
- Equilibrium diagrams (see also *Alloys*),
 large scale, 39.
 principles, book, 492 (*review*).
 quaternary, 465.
 significance, 466.
 value in detg. suitable heat-treatment, 51.
- Erbium, detection. See *Analysis*.
- Estimation. See *Analysis*.
- Etching (metallographic),
 macro-, 220.
 reagents, for macrostructure, 99.
- Etching (metallographic) of—
 Lead alloys, 156.
 Tantalum, 220.
- Etching (process),
 book, 319.
 coloured letters, plaques, &c., 119.
- Ethane, adsorption by powdered metals,
 502.
- Ethylene, adsorption by powdered metals,
 502.
- Europe, Roman mines, book, 407.
- Europium,
 atomic weight, 657.
 preparation, 200.
 separation. See *Analysis*.
- Eutectics. See *Alloys*.
- Eutectoids. See *Alloys*.
- Evaporated films. See *Films*.
- Everdur. See *Alloys*.
- Exhaust systems, book, 649.
- Expansion. See *Thermal expansion*.
- Extensometers. See *Testing machines*.
- Extrusion,
 flow of metals, 74.
 presses, for continuous prodn. of cable-
 sheath & pipe, 724; for lead cable-
 sheath, 445.
 review, 538.
- Extrusion of—
 Aluminium, lubricants, 32.
 Lead, cable-sheath, 74; prevention of
 entry of lead oxide in chamber, 257.
 Magnesium, dependence of specific
 pressure on temp. & elongation factor,
 116, 117.
 Magnesium alloys, 251.
- F.M. alloy. See *Alloys*.
- Fahrig's antifriction metal. See *Alloys*.
- Failure,
 mechanism, 335; effects of thermal stress
 & strain, 335.
- Fatigue (see also *Alloys & under names of*
metals),
 atmospheric action, 383.
 corrosion-. See *Corrosion-fatigue*.
 effect of notches (chem. or mech. formed),
 5, 85.
 relation to modern engine design,
 booklet, 409.
 testing. See *Testing, & Testing machines*.
- Fermet. See *Alloys*.
- Fernichrome. See *Alloys*.
- Fernico. See *Alloys*.
- Ferran (bimetal), properties, 104.
- Ferro-alloys. See *Alloys*.
- Ferromagnetic materials (see also *Alloys*
 & under names of metals),
 classical model, 6.
 demagnetization factor of cylindrical
 rods, 460.
 elasticity, Young's modulus, effect of
 magnetization, 565.
 electrical resistance, anomaly, 417, 502.
 galvanomagnetic effects, 212.
 gyromagnetic effect above Curie point,
 559, 660.
 magnetic permeability, at low inductions,
 6; detn., 68; dispersion, theory,
 668.
 magnetization, change in thermal energy
 accompanying, 139; intensity, effect
 of a.c., 465.
 magnetization function, 49.
 mechanical oscillations due to magneti-
 zation, damping, 212.
 polycrystalline plates, energetic & mag-
 netic anisotropy in magnetic field,
 668.

- Ferromagnetic materials.**
 single crystals. See *Single crystals*.
 skin effect, 579.
 thermoelectric properties, variation with magnetic field & temp., 566.
- Ferromagnetism** (see also *Alloys* & under names of metals),
 and liquid mixtures, analogy, 50.
 new aspects, 460.
 of metal crystals, 144.
- Ferrul alloy.** See *Alloys*.
- Ferry metal.** See *Alloys*.
- Filaments** (see also *Tungsten*, &c.),
 incandescence, construction from Nernst material, 616.
- Films** (see also *Foils* & under names of metals),
 coloured, on metals, electrodeposition, 702.
 crystalline (condensed in vacuum), structure, 591.
 crystallization, 287, 469.
 diffraction of cathode rays, detection, 27.
 effect of light on elect. resistance, 48.
 electrical conductivity, 49, 210; in electrostatic field, 210; second effect of elect. charge, 210; temp. coeff., 49.
 electron diffraction patterns, intensity distribution, 225.
 evaporated, development of process, 318; optical study, 287, 469; prodn., 405; structure, 143.
 examination by electron microscope, 712.
 light-scattering, 336.
 optical constants, 48.
 oxide, electron diffraction study, 59; on molten metals, electron diffraction, 99, 687; orientation, 687.
 protective, comparison of effectiveness, 697.
 sputtered, optical properties, 200; phys. properties, 590; structure, 143, 590.
 sputtering. See *Cathodic sputtering*.
 structure, 284, 343, 468.
 superconductivity, 277.
 transparency in ultra-violet, 276.
 transparent, validity of Drude's optical method for studying, 288, 469.
 very thin, prodn., 224.
- Finishing** (see also *Colouring*, *Deposition*, *Enamelling*, *Galvanizing*, *Lacquering*, *Painting*, *Polishing*, *Tinning*, &c.),
 book, 549.
- Firebricks.** See *Refractory materials*.
- Fireclay.** See *Refractory materials*.
- Firmi-Dirac statistics**, appn. to metals, 206.
- Flax**, retting of, effect of metals, 317.
- Fletcher's bearing metal.** See *Alloys*.
- Flint metal.** See *Alloys*.
- Flow of metals** (see also *Creep*, *Plastic deformation*, &c.),
 in extrusion, 74.
 in rolling. See *Rolling*.
 investigation by Hele-Shaw apparatus, 532, 715.
 resistance to, in static compression, 724.
- Flowability.** See *Castability*.
- Fluidity**, 534; see also *Alloys*.
- Fluxes**, 716.
 chloride, action on oxides in aluminium, 534.
 soldering. See *Soldering*.
- Foils** (see also *Films* & under names of metals),
 adhesives for, 37.
 as wallpaper, 265.
 in packing foods, developments, 188.
 joining, 312.
- Fontane's metal.** See *Alloys*.
- Foods.**
 action on metals. See *Corrosion*.
 contamination by pipes, 645.
 heavy metals in, bibliography, 39.
 industry, materials for, 404.
- Forbe's metal.** See *Alloys*.
- Forging**,
 book, 649.
 flow-resistance, 724.
 manipulator, 5-ton, 724.
- Forging of—**
 Aluminium, 74; hot-, 724; power consumption, 629.
 Aluminium alloys, 74, 75, 117, 118; hot-, 724; power consumption, 629.
 Aluminium-bronze, 75.
 Anticorodal, hot-, 724; power consumption, 629.
 Brasses, book, 411 (review); hot-, 724.
 Bronzes, 75.
 Chromium-nickel alloy elect. heating elements, 509.
 Copper alloys, 75, 182.
 Duralumin (Avional), hot-, 724; power consumption, 629.
 Elektron, 445.
 Magnesium alloys, 251.
 Peraluman, power consumption, 629.
- Foundry**,
 charcoal, 623.
 conveying equipment, selection, 623.
 developments, 179.
 Electric Autolite Co. (U.S.A.), 178.
 in Madeira, 178.
 laboratory control, 250.
 maintenance, 625.
 non-ferrous, problems, 307.
 plant, exhibition, 250.
 practice, book, 650; developments 482; review, 621; see also *Casting*, *Melting*, &c.
 reference book, 326 (review).
 Russian, of Gorkovsk auto-works, 70; of Kcharkoff tractor works, 70.
- Fourdrinier metal.** See *Alloys*.
- Fracture**, separating (*Trennungsbruch*), 355.
 under repeated stress. See *Fatigue*.
- France**,
 Association Technique de Fonderie, year-book, 406.
 Universities, directory, 267.
- Frary alloy.** See *Alloys*.
- Freezing points.** See under names of metals.
- Fricke's nickel-brass.** See *Alloys*.

- Friction,
 and lubrication, 582.
 between metals, surface temp., 563.
 Frischmut solder. See *Alloys*.
 Fritting, 544.
 Fruits, corrosion by. See *Corrosion*.
 Fuels (see also *Coal*, *Gases*, *Liquid fuels*,
 Petrol, &c.),
 heating values, 537.
 industry, book, 489.
 Fungi, effect of metals at a distance, 738.
 Furnaces,
 air-heating blowers, 442, 482.
 air preheater, regenerative, 626.
 annealing, advances, 358; electric. See
 Furnaces, *electric annealing*; for
 brass, 73.
 arches, 255.
 atmospheres, controlled, 718.
 bright-annealing, electric *v.* coal-fired,
 627.
 capacity, factors affecting, 252.
 coal-dust firing, 114.
 coke-fired crucible, forced-draught, 719.
 construction, metals in, 114.
 convection heating, 719; air heaters for,
 719.
 copper-refining, acid & basic bottoms,
 309; charging machine for, 718.
 costs, detn., 626.
 crucible, 481, 626.
 electric, 254; at Paris Mint, 627;
 automatic temp. control, 621; book,
 648; developments, 359; exhibition,
 627; fundamental equations for
 design, 359; heat distribution, losses,
 &c., 442; heating elements, ceramic,
 537; heating elements. See also
 Alloys; in Italy, 627; max. load for
 Silic heating elements, 255; metal-
 lurgical & economic aspects, 482;
 regulation, 30; 3-phase, reactance,
 359, 442; *versus* fuel-fired, 626.
 electric annealing, for light metals, 114;
 for strip and wire, continuous, 30.
 electric arc, Heuland, 308; null-poten-
 tial, 308.
 electric bright-annealing, 358; Grüne-
 wald, 256, 358.
 electric heat-treatment, 114, 180; for
 Duralumin rivets, 537; for low-temp.
 treatment, 395; progress, 253, 627.
 electric H.-F. induction, 537, 627;
 high current condensers, 254.
 electric induction, design, 719; mono-
 lithic linings for, 721.
 electric melting, Ajax-Wyatt, bottom
 brick for, 721; book, 491; carbon &
 graphite electrodes, 719; current
 conducting properties of slags in,
 254; for aluminium, 254; for alu-
 minium & its alloys, 179; for Babbitt,
 180; for type metal, 442; progress,
 253, 627.
 electric radiation, carbon resistance, 254;
 graphite resistor, 482, 627, 719.
 electric resistance, development in U.S.A.,
 114; for high temperatures, 482;
 resistor materials, 254; with air
 circulation, 114.
 Furnaces,
 fuel-fired, control of temp. & atm.,
 30; *versus* electric, 626.
 gas burners, research, 537.
 gas-fired, combustion research with
 burners of different mixing character-
 istics, 73, 537; data on gas combustion,
 626.
 gas-fired heat-treatment, for relieving
 strains in large welded vessels, 180;
 selection & management, 253.
 gas-fired melting, for brass, 626; for
 white metals, 253.
 gases flowing through, temp. distribu-
 tion, 31.
 grates, 482.
 heat calculations, 253.
 heat generation, 442.
 heat loss through walls, calculation, 720.
 heat-transmission through furnace walls,
 bare & insulated, 723.
 heat-treatment, electric. See *Furnaces*,
 electric heat-treatment; *Elfurno* gas
 atmosphere, 359, 719; for aluminium
 alloys, 442; for aluminium & its alloys,
 253; forced convection, 719; gas-
 fired. See *Furnaces*, *gas-fired heat-*
 treatment.
 Heuland, 308.
 high-temperature insulation, 359.
 laboratory. See *Laboratory apparatus*.
 linings, ramming, 254.
 melting, electric. See *Furnaces*, *electric*
 melting; for aluminium & its alloys,
 253; vacuum-, for aluminium alloys,
 176.
 oil-fired heat-treatment, selection &
 management, 253.
 oil-firing, 308.
 radiant tube, atmospheric control, 536.
 refractories. See *Refractory materials*.
 reversed combustion, 114.
 rotating melting, heating, 114.
 salt-bath, danger of explosions, 253.
 temperature control, automatic, 716.
 thermal efficiency, factors affecting,
 252.
 wall temperature, relation between gas
 temp. and, 73.
 walls, heating, 180.
 Fuse wire, melting time, 644.
 Fusible alloys. See *Alloys*.
 Fusion process, theory, 588.
 Gadolinium, pure, prepn., 333.
 Gallium,
 atomic weight, 557.
 detection. See *Analysis*.
 electrical resistance of single crystals,
 change in magnetic field, 556.
 electrochemistry, review, 239.
 freezing point, 3, 85.
 internal pressure, 465.
 literature, review, 200.
 melting point, 3.
 occurrence, 663.
 optical constants, 657.
 preparation, 455.
 properties, review, 663.

- Gallium.**
 pure, prepn., 3, 84.
 purification, 556.
 single crystals. See *Single crystals*.
 statistics, 738, 740.
 superconductivity, 567.
 supercooling, 207.
 uses, 663.
- Gallium alloys.** See *Alloys*.
- Galvanic elements, eutectic, 475.**
- Galvanized iron & steel,**
 bend tests, 432.
 cadmium poisoning from kettle, 35.
 coatings, detn. of phase structure by anodic dissoln., 285, 470; Preece test, pamphlet, 83; testing, 521.
 corrosion. See *Corrosion*.
 enamelling. See *Enamelling*.
 finishes, 104.
 hardware & fastenings, A.S.T.M. specifications, 104.
 painting. See *Painting*.
 sheet, thickness of coating, detn., 385, 600.
 tin-plating. See *Deposition*.
 welding. See *Welding*.
 wire, thickness of coat, detn., 385, 522, 600.
- Galvanizing,**
 bath surface, 432.
 baths, prevention of overheating, 601.
 defects, effect of material & bath compn., 385.
 dross level, variation, 601.
 effect of aluminium, 233, 601.
 effect of impurities in zinc, 431.
 effect of lead, 233.
 electro-, 298; economics, 601.
 faults, book, 39; caused by faulty steel, 600.
 fluxes, 432; appn. of zinc ammonium chloride, 473.
 hard zinc formation, 232, 521, 602.
 hot-, double-dip process, 233; drossing temp., 385; effect of time of submersion, 385; formation of hard FeZn layer, 521; glycerin as flux conditioner, 298; heating of bath, 164; in boiler-making, 164; in constructional work, 164; lengthening life of pots, 297; mechanical, 601; mechanism, 92; metal losses, 602; of small articles, centrifugal process, 601; processes, 164; review, 298; zinc ammonium chloride in, 348.
 pots, dipping-out, 602; increasing life, 601.
 report on campaign of Amer. Zinc Inst., 322.
 spangles, factors affecting prodn., 601.
- Galvanizing of—**
 Iron and steel, strip, electro-, economics, 601; wire, 601.
 Sheets, mechanical, 297.
 Strip, mechanical, 521.
 Tubes, mechanical, 521; semi-mechanical, 521.
 Wire, coating regulator, 298; electro-, 298, 607; hot-, costs & profits, 601; important points, 601; mechanical, 521.
- Galvanomagnetic effects** (see also *Alloys* & under names of metals),
 in ferromagnetic materials, 212.
- Galvanomagnetic phenomena** (see also *Hall effect, &c.*),
 in crystals, theory, 668.
 theories, 668.
- Galvanoplastics, 238.**
- Gas(es)** (see also under names of gases),
 absorption by liquids & solids, 559.
 action on refractories. See *Refractory materials*.
 activation by metals, 666.
 adsorption, by metal powders, 556; by molten metals, review, 665.
 analysis. See *Analysis*.
 as industrial fuel, 719.
 clean-up by metals, 36.
 combustion, balance equation of, 626; data, 626.
 corrosion by. See *Corrosion*.
 desorption from sooted surfaces in vacuum, 666.
 diffusion, through metals, 563, 665; through metals, equations, 369.
 estimation. See *Analysis*.
 flame, temp., & latent energy, 720.
 in aluminium, 197.
 in metallurgy, uses, booklet, 649.
 in metals, bibliography, 534; detn. by Straube-Pfeiffer apparatus, 532; effects, 716; removal, 704, 705; removal, symposium, 622, 623; review, 665.
 interaction with solids, 665.
 nomograms, 253.
 producer, for furnace heating, 537.
 town's, products of combustion, materials to resist, 693.
 waste, temps., measurement, 620.
- Gedge's brass.** See *Alloys*.
- Gemma bearing alloy.** See *Alloys*.
- Genelit.** See *Alloys*.
- German silver.** See *Alloys: Nickel-brasses*.
- Germania white bronze.** See *Alloys*.
- Germanium,**
 analysis. See *Analysis*.
 estimation. See *Analysis*.
 literature, review, 200.
 occurrence, 663.
 properties, review, 663.
 statistics, 740.
 uses, 663.
- Germanium alloys.** See *Alloys*.
- Germany,**
 Deutsche Materialprüfungsanstalten, proceedings, 320.
 Dürener Metallwerke A.-G., development 1885-1935, 543, 546.
 Kaiser Wilhelm-Institut für Metallforschung, history, 543; review of works, 646.
 standards, book, 190; metallurgical, book, 490.
- Gilding metal.** See *Alloys*.
- Giuschi-Buischi.** See *Alloys*.
- Glass,**
 adherence to metals, 634.
 metal coating in vacuum, 317.

- Glass-metal joints**, 68, 183, 362, 646, 736.
 effect of temperature, 634.
- Glievor bearing alloy**. See *Alloys*.
- Glucinum**. See *Beryllium*.
- Gold** (see also *Precious metals*),
 anodic passivation, 3, 276.
 assay. See *Analysis*.
 bibliography, 735.
 buffing. See *Buffing*.
 cold-work, recovery from, review, 142.
 colouring. See *Colouring*.
 compressibility, 416.
 dental crowns, construction, cadmium as aid in, 97.
 deposition. See *Deposition*.
 detection. See *Analysis*.
 diffusion into lead, 52.
 diffusion of positive ions of salts at high temps., 556.
 electrical resistance at low temps., 200.
 electrode dispersion, 608.
 electron diffraction patterns, 224, 591.
 estimation. See *Analysis*.
 extraction, 262, 641.
 films, effect of light on elect. resistance, 48; elect. conductivity in electrostatic field, 210; electron diffraction patterns, 225; reflectivity, 48; sputtered, crystn., 287; sputtered, effect of heat on structure, 15; sputtered, structure & phys. properties, 590; temp. coeff. of elect. conductivity, 49; transparency in ultra-violet, 276; very thin, reflection factor, 564.
 fuse, failure in contact with nickel-chromium alloy, 658.
 hall-marking, law & practice, book, 653 (review).
 heat of relaxation from recrystn. data, 563.
 history, 262.
 in dentistry, 79.
 industry, book, 651; in 1935, 127; in U.S.A., book, 131.
 leaf, manuf., properties & uses, 118, 538.
 magnetic susceptibility, change, 460; of powders, variation with particle size, 565.
 metallurgy, book, 266.
 occurrence, 262, 641.
 ores, flotation, book, 489.
 oxide film, 366.
 passivity, 498.
 polished, thickness of amorphous layer, 288, 468.
 powders, 544; pressed, elect. conductivity, 6; pressed, hardening effects, 6.
 primitive use, 735.
 properties, review, 643.
 refining. See *Refining*.
 residues, elect. recovery, 179.
 separation. See *Analysis*.
 soldering. See *Soldering*.
 sorption of water vapour, 557.
 spherulitic particles, prodn. by slow crystn., 54, 683.
- Gold**,
 statistics, 735; for 1933, 740.
 thermal expansion, x-ray detn., 208.
 uses, 737.
 vapour pressure, 209.
 volatilization through chloride, 502.
 "white." See *Alloys*: *White gold*.
- Gold alloys**. See *Alloys*.
- Grain distortion during heat-treatment**, 586.
- Grain-growth** (see also *Alloys* & under names of metals),
 in cold-worked metals, 587, 684.
 mechanism, 423.
- Grain-size** (see also *Alloys* & under names of metals),
 determination in region 1 to 100 μ , 380.
 effect on creep-resistance, 154.
 effect on high temperature characteristics, 154.
 effect of tensile properties, 154.
 in cast metals, 220.
 relation to dendrite fineness, 585.
 symposium, 154.
- Graphite**. See *Refractory materials*.
- Graphs**, plotting, 307.
- Gravimetric analysis**. See *Analysis*.
- Gravity casting**. See *Die-casting*.
- Great Britain**,
 Armstrong College, report of Standing Committee for Research, 318.
 Birmingham small non-ferrous products trade, 112.
 Birmingham Jewellers' & Silversmiths Association, report, 318.
 British Engineers' Association, handbook, 319.
 British Non-Ferrous Metals Research Association, report, 406; work of, 317.
 British Science Guild, report, 406.
 British Standards Institution, handbook, 128, 545.
 Department of Scientific and Industrial Research, report, 128.
 Imperial College of Science & Technology, calendar, 547.
 Imperial Institute, report, 320.
 Incorporated Swansea Exchange, report, 490.
 Institution of Mechanical Engineers, index to proceedings, 547; list of members, 408.
 Iron & Steel Institute, list of members, 649.
 Junior Institution of Engineers, index to papers, 649.
 National Physical Laboratory, collected researches, 548; report, 321.
 Royal Mint, report, 38.
 Royal Society of London, year-book, 131.
 Royal Technical College, Glasgow, report, 131.
 scientific & learned societies, year-book, 86.
 statistics, official, guide to, 650.
 tinplate industry, history, 188.
 Universities, year-book, 270.
 University of Oxford, theses, 321.

- Grinding of—**
 Aluminium, 361, 634.
 Aluminium alloys, 361, 634.
 Monel metal, 633, 651.
 Nickel, 259.
 Nickel alloys, 259.
- Grinding wheels, abrasive action, 361.**
- Gun-metal. See Alloys.**
- Gyromagnetic effect (see also *Alloys* & under names of metals),**
 in ferromagnetics above Curie point,
 559, 660.
- Hafnium,**
 occurrence, 663.
 properties, review, 663.
 superconductivity, 211; transition temp.,
 568.
 uses, 663.
- Hafnium carbide. See Alloys.**
- Hall effect (see also *Galvanomagnetic phenomena, Alloys, & under names of metals*),**
 and magneto-resistance effect, 566.
- Hallwach's effect, 564.**
- Hard alloys. See Alloys: Super-hard alloys.**
- Hardening,**
 age-. See *Age-hardening.*
 transformation-, 290.
 work-, mechanism, 501.
- Hardness (see also *Alloys & under names of metals*),**
 definition, 207.
 effect of temperature, 619.
 need for study, 207.
 of powdered metals, 6.
 relation to strength & workability,
 131.
 testing. See *Testing, & Testing machines.*
- Heat losses, insulation against, 115.**
- Heat of relaxation, calculation from**
 recrystn., 563.
- Heat-resistant materials (see also *Alloys*),**
 99, 420, 570, 571, 648.
 book, 549.
- Heat-treatment (see also *Age-hardening, Annealing, Quenching, &c.*),**
 baths, testing of nitre melt, 538, 629.
 books, 88 (*review*), 192 (*review*), 265,
 489, 549.
 by forced convection, 719.
 furnaces. See *Furnaces.*
 grain distortion during, 586.
 in magnetic field, 629.
 salt-baths, alloy containers for, 629.
- Heat-treatment of—**
 Aircraft materials, book, 191.
 Alloys, progress, 723; value of know-
 ledge of equilibria, 51.
 Aluminium alloys, 1, 29, 442; factors
 governing, 180; temperature control,
 simple method, 621.
 Beryllium-copper alloys, 673.
 Bronzes, effect on tensile properties,
 505.
 Chromium-gold alloys, 9.
 Chromium-nickel alloy elect. heating
 elements, 509.
- Heat-treatment of—**
 Copper, 181.
 Duralumin, 445; effect on mech. pro-
 perties & structure, 629.
 Elektron, 445.
 Iron-nickel alloys, grain-distortion, 586.
 Magnesium alloys, 1.
 Permalloy in magnetic field, 579.
 Perminvar in magnetic field, 579.
 Phosphor-bronzes, 307.
 Steels, books, 265, 406; grain-distortion,
 586.
- Hemp, retting of, effect of metals, 317.**
- Herculoy. See Alloys.**
- Heusler's alloys. See Alloys.**
- High melting point metals, solution in low**
 m.p. metals, 584.
- High-pressure phenomena,**
 bibliography, 666.
 theoretical aspects, 666.
- High temperatures,**
 properties at, tests for, 139.
 strength of metals at, 110, 174.
- Hochheim alloy. See Alloys.**
- Homogeneity. See Alloys & under names**
 of metals.
- Homogeneous substances, modifications,**
 209.
- Hot-forging. See Forging.**
- Hot-galvanizing. See Galvanizing.**
- Hot-working. See Forging, Pressing,**
Rolling, &c.
- Hume-Rothery rule, 14, 219, 284, 426,**
 589, 590.
- Hydrochloric acid, corrosion by. See**
Corrosion.
- Hydrogen (see also *Gases*),**
 absorption, by copper, 665; by iron-
 molybdenum alloys, 151; by nickel,
 274, 660; by palladium, 559.
 adsorption, by cobalt, 199; by copper,
 656; by nickel, 274; by palladium,
 203; by palladium in presence or
 absence of water, 559; by platinum,
 660; by powdered metals, 502; by
 reduced nickel, 139; by tungsten,
 92, 560; in pickling & deposition,
 review, 665.
- allotropic forms, sepn. by diffusion**
 through palladium, 559.
- diffusion, through aluminium, 197, 553;**
 through copper, 139; through copper-
 nickel alloys, 139, 563; through iron,
 203, 563; through metals, 665;
 through molybdenum, 563; through
 nickel, 139; through nickel-chrom-
 ium alloys, 139; through palladium,
 203, 366, 367, 559; through palladium,
 mechanism, 560.
 electrodes, investigations, 240.
 occlusion by palladium, 203, 456.
 overvoltage. See *Overvoltage.*
 solubility in molten aluminium, 553.
- Hydrogen-ion concentration,**
 applications, book, 546.
 measurement, book, 408.
- Hydrogen peroxide, action on aluminium,**
 17.
- Hydrogen sulphide, corrosion by. See**
Corrosion.

Hydranalium. See *Alloys*.

Hytenzyl bronze. See *Alloys*.

Ice plant, corrosion of. See *Corrosion*.

Ignition temperatures (see also under names of metals),
of solids, detn., 90.

Illuminators. See *Laboratory apparatus*.

Impact, stresses due to, photoelastic study, 392.

Impact strength. See *Alloys* & under names of metals.

Impurities, removal, 716.

Incandescent metals, photoelectric effect, 564.

Inclusions, study with polarizing microscope, 108.

Inconel. See *Alloys*.

Indium,

atomic weight, 498.

bibliography (1863-1933), 138.

crystal structure, 686.

detection. See *Analysis*.

estimation. See *Analysis*.

literature, review, 200.

occurrence, 663.

properties, review, 663.

statistics, 738, 740.

uses, 79, 663.

Indium alloys. See *Alloys*.

Industrial maladies, book, 409.

Ingots,

crystallization, 683.

density, determination, 208.

Insects, attack on lead cable-sheath, 201, 334.

Inspection,

in automobile industry, 618.

metallurgical, 438.

U.S. Navy specifications, 618.

Intermetallic compounds. See *Alloys*.

Internal stresses (see also *Season cracking*, *Alloys*, & under names of metals),

bibliography, 663.

determination, methods, 68, 246, 663.

in tubes, measurement, 246.

resulting from age-hardening, 583.

Invar. See *Alloys*.

Inverse segregation (see also *Alloys*),

volume changes by diffusion in relation to, 154.

Ions,

adsorbed on surfaces, equilibrium, 93.

and charged particles, transference in gaseous media & elect. field, 647.

common discharge, 240.

Impact testing. See *Testing*, & *Testing machines*.

Iridium (see also *Platinum metals*),

assay. See *Analysis*.

detection. See *Analysis*.

estimation. See *Analysis*.

separation. See *Analysis*.

uses, 737.

Iridium alloys. See *Alloys*.

Iron,

bibliography, 268.

cast, book, 491.

cementation. See *Cementation*.

Iron,

chemistry, books, 136 (review), 494 (review).

cold-work, recovery from, review, 142.

colouring. See *Colouring*.

compressibility, 416.

corrosion. See *Corrosion*.

creep, 93; abnormal, during transformation, 671.

deformation texture, review, 224.

detection. See *Analysis*.

diffusion of aluminium, 104; at low temps., 280.

diffusion of chromium, x-ray study, 672.

diffusion of hydrogen, 203, 563, 665.

diffusion of titanium, 466.

disperse phase, prodn., 564.

effect of ozone, 19.

elasticity, Young's modulus, effect of magnetization, 565.

electrical resistance, 502.

electron diffraction patterns, 224.

estimation. See *Analysis*.

films, sputtered, threshold value, 564.

galvanized. See *Galvanized iron & steel*.

galvanizing. See *Galvanizing*.

grain-growth during recrystn., 587, 684.

heat of relaxation from recrystn. data, 563.

inclusions, bibliography, 268.

magnetic susceptibility, dependence of frequency, 202.

magnetostriction in single crystals, 91.

metallographic etching, 682.

oxidation, rate, 499.

passivity, 454.

photoelectric emissivity, effect of adsorbed gases, 560.

photoelectric thresholds in turned state, 93.

Piobert effect, 665.

polished surfaces, structure, 590.

polymorphism, review, 92.

powder, adsorption of hydrogen, ethane, & ethylene, 502.

recovery from cold-work, 414.

recrystallization, 587.

scaling, 499.

separation. See *Analysis*.

service pipes, suitability, 518.

single crystals. See *Single crystals*.

specific heat, true, 370.

thermal conductivity, effect of cold-work, 277.

viscous deformation of wires, 139.

volatilization through chloride, 502.

welding. See *Welding*.

wire, crystal orientation, effect of method of working, 16; viscous deformation, 139.

Iron alloys. See *Alloys*.

Iso-Elastic. See *Alloys*.

Isoperm. See *Alloys*.

Isotopes, review, 145.

Isotropic bodies, mechanics in plastic state, 209.

J.B. 38 A. See *Alloys*.

Japan.

aluminium industry, 80, 318.

magnesium industry, 80, 647.

National Research Council of Japan, report, 548.

Ryōjun College of Engineering, commemoration volume to K. Inouye, 85.

Japanning, 312.

K.S. (magnet alloy). See *Alloys*.

K.S.-Seewasser. See *Alloys*.

Kainite solutions, corrosion by. See *Corrosion*.

Kanthal. See *Alloys*.

Kikoin-Noskov effect, theory, 668.

Konel. See *Alloys*.

Kookaburra. See *Alloys: Solders*.

LABORATORY APPARATUS.

Contorograph, 55.

Debye-Scherrer cameras, device for centering specimen tubes, 391.

Dilatometers, high-sensitivity, 89; magnetic, 245.

Electron diffraction apparatus, 305, 479.

Electron diffraction cameras, 246, 289, 617.

Electron microscopes, 479, 712.

Ferrometer, 175.

Furnaces, apparatus to increase or decrease temp., 616; elect., construction from Nernst material, 616; elect., for very high temps., 532; elect. arc, 532; elect. H.F. induction, 109; elect. induction, 437; elect. resistance, for heating in hydrogen, 391; elect. resistance, variation of temp., 437; platinum resistor, to operate at 1550° C., 616; resistances for, water-cooled, 172.

Glow discharge tube, 437.

Goniometers, 617.

Illuminator for printing Laue photographs, 532, 617.

Illuminators (microscope), elimination of lens-flare, 109.

Metallographic films, 284.

Micro-calorimeter, differential, 27.

Micro-influentimeter, 617.

Microphotometers, non-recording photo-electric, 246; self-registering, 246.

Microscope eye-piece, photo-elect., for measurement of reflecting power of materials, 616.

Microscope objectives, 109; prevention of deposition of water vapour, 479.

Microscopes, inclination unit, 616; toolmakers', 245; ultra-violet, 68; with reflected light, advances, 354.

Orthotest, 617.

Ovenograph, 250.

Panphot, 245, 617.

Permeability-tension test apparatus, 68.

Photoelastic equipment, 173.

Photoelectric cells, uses, book, 132.

Photomicrographic apparatus, 531.

Laboratory apparatus.

Polarizing microscope, appn. to chem. problems, 329 (*review*); appn. in study of inclusions, 108; theory & use, 156, 320, 682.

Potentiometers, precision, 621.

Pyrometers. See *Pyrometers*.

Reagent feeder, 391.

Reflection meters, 172, 739.

Resistances, elect. furnace, water-cooled, 172.

Spectrometer, two-crystal moving film, 27.

Styloscope, 109.

Temperature indicators, 440.

Temperature regulators, 69, 249, 716;

automatic, 393; for elect. furnaces, 621.

Testing machines. See *Testing machines*.

Thermal expansion apparatus, autographic, 26, 86.

Thermocouples. See *Thermocouples*.

Thermometer controller, 69.

Thermometers, resistance, for use below 10° K., 620.

Thermopiles, sensitivity, 69.

Thermostats, exhibition, 174; for thermo-optical studies with reflecting goniometer, 391.

Tube generator for induction heating, 245.

Weights, precision, devices to ensure constancy, 173.

X-ray cameras, 245, 713; diameter, detn. from x-ray diagram of revolving crystal, 688.

X-ray equipment for use at high temps., 617.

X-ray film, absolute x-ray intensities & sensitivity, measurement, 68.

X-ray window, use of lithium, 68.

Lacquering, 361

book, 545.

preparation for, 118.

use of pure lac resin, 605.

Lacquering of—

Aluminium, elect.-heater frames, 119; foil with pure lac resin, 605.

Collapsible tubes, 726.

Copper with pure lac resin, 605.

Tin foil with pure lac resin, 605.

Thinplate, 119, 726; with pure lac resin, 605.

Lacquers, standards, A.S.T.M., book, 647.

Lactic acid, corrosion by. See *Corrosion*.

Lanolin rust preventers, 349.

Lanthanum,

atomic weight, 557.

production, 199.

pure, prepn., 141.

Lanthanum alloys. See *Alloys*.

Latent heat, book, 491.

Lattice constants. See *Crystal lattice*.

Lattice structures. See *Crystal structure*.

Laue diagrams. See *Crystal structure*.

Lautal. See *Alloys*.

Lead,

absorption of hard x-rays, 43, 201.

action of nitrogen at low pressures, 276.

Lead,

- analysis. See *Analysis*.
- atomic weight, 498, 557, 659.
- attack by insects, 334.
- boiling point, 502.
- buffing. See *Buffing*.
- burning. See *Welding*.
- cable-sheath, attack of insects, 201, 334; extrusion. See *Extrusion*;
- longitudinal cracks, 658; manuf., 74, 187; micro-examination, 156.
- coating, homogeneous, 297; of cold-rolled strip, 600; oxy-acetylene, 385; review, 164.
- cold-work, recovery from, review, 142.
- compressibility, 416.
- consumption, in U.S. storage battery industry, 642.
- contamination of foods, 543.
- corrosion. See *Corrosion*.
- creep, 576; fracture, 273; of single crystals, 333, 658.
- cylinders, resistance to dynamic compression, 724.
- deposition. See *Deposition*.
- detection. See *Analysis*.
- diffusion of gold, 52.
- distorted, effect of silver on rate of recrystn., 201.
- dross, sepn. of traces of gallium, 455.
- effect of heat-treatment on mech. properties, 200.
- effect of impurities, 200, 201.
- elasticity, 138.
- electrical resistance at low temps., 200.
- electrode potentials, in liquid ammonia, 704.
- electrodeposited, arrangement of micro-crystals, 512.
- electron diffraction patterns, 591.
- elongation, effect of interrupted straining, 658.
- entropy, 564.
- estimation. See *Analysis*.
- extrusion. See *Extrusion*.
- fatigue failure, 340.
- films, superconductivity, 659; transparency in ultra-violet, 276.
- friction on steel, surface temp., 563.
- heat of relaxation from recrystn. data, 563.
- in architecture, 126, 642, 735.
- in chemical industry, 263, 316, 645.
- in drinking water, 641.
- in food industries, 735.
- in foundry practice, 394.
- in oil industry, 450.
- in paper timber industry, 403.
- in ships, 263.
- in storage cells, electrochem. behaviour, 528, 703.
- industry, in 1935, 127; London Lead Co. (1692-1905), 452.
- joining, 398.
- metallography, prepn. of specimens, 342.
- metallurgy, advances, 80, 735.
- molten, oxide films, electron diffraction study, 99; tarnishing, 687.
- ornamental work, 187.
- oxidation, electron diffraction study, 59.

Lead,

- oxide layer, structure, 590; thickness, 334.
- parachor, 564.
- photoelectric thresholds in turned state, 93.
- pig, A.S.T.M., specifications, 125; automatic trimmer, 177.
- pipes, Roman, 293; tables, 190.
- plasticity by slipping, 658.
- poisoning, 452; in cutting lead-coated iron, 318; incipient, test, 647.
- properties, reviews of literature, 498, 658.
- recrystallization, effect of silver, 201.
- refining. See *Refining*.
- rolling. See *Rolling*.
- separation. See *Analysis*.
- service pipes, suitability, 518.
- shear strength, effect of rate of shear, 43.
- sheets, joining, 735.
- single crystals. See *Single crystals*.
- softening, 241.
- soldering. See *Soldering*.
- sprayed coatings, tests in alkaline liquors, 602.
- spraying. See *Spraying*.
- statistics, 735.
- superconductivity, 659.
- thermal expansion, 43.
- torsion diagrams, 356.
- tubes, effect of antimony on tensile properties, 215, 507; hydraulic tests, 153; joints, 37; tensile properties, 153.
- uses, 658 (see also entries above).
- vapour pressure, 209, 502.
- viscosity, 498.
- welding. See *Welding*.
- wetting power, 501.
- wires, thin, prepn. by freezing molten metal, 501.
- Lead alloys. See *Alloys*.
- Lead amalgam $[\text{PbSO}_4/\text{CuSO}_4]$ copper amalgam cell, activity, 609.
- Leather,
 - industry, materials for, 645.
 - staining by copper, 734.
- Leonard effect, 717.
- Leukotized coatings, 700.
- Lineage structure. See *Crystals*.
- Linseed oil,
 - boiling, resistant material, 17.
 - corrosion by. See *Corrosion*.
- Liquid fuels (see also *Petrol*, &c.),
 - books, 408, 653 (review).
 - corrosion by. See *Corrosion*.
- Liquid metals. See *Molten metals*.
- Liquid state, 279.
- Lithium (see also *Alkali metals*),
 - book, 494 (review).
 - chemical properties, 201.
 - constitution, theoretical, 289.
 - detection. See *Analysis*.
 - electrical conductivity, effect of pressure, 143.
 - electrical resistance, effect of pressure, 274.
 - electrode potential, standard, in methyl alcohol, 499.

Lithium.

- electronic energy bands, 143.
- estimation. See *Analysis*.
- physical properties, 201.
- production, electro-, 106.
- properties, 274.
- specific heat, anomaly, 201.
- statistics, 80, 738.
- thermoelectric force, 456.
- uses, 79, 201, 274, 642.
- volume changes, effect of pressure, 274.
- x-ray window, 68.

Lithium alloys. See *Alloys*.**Locomotives,** fire-box stays, loosening on cooling, 402.**Logarithmic tables,** 490, 492.**Low-melting point metals,** solution of high m.p. metals, 584.**Low temperatures,**

- attainment, magnetic methods, 172, 532, 563, 566.
- phenomena, 568.
- physics, book, 135 (*review*).
- properties at, *review*, 93, 665; see also *Alloys* & under names of metals.
- thermal behaviour at, 144, 502.

Lubrication, 582.**Machine construction,**

- book, 83.
- tables, 491.

Machining (see also *Cutting*, & under names of machining processes),

- book, 412 (*review*).

Machining of—

- Aluminium & its alloys, 259.
- Monel metal, 118, 633, 651.

Magnalium. See *Alloys*.**Magnesite.** See *Refractory materials*.**Magnesium,**

- action of carbon dioxide, 138.
- action of nitrogen, 209.
- action of water, 138.
- analysis. See *Analysis*.
- chemical thermodynamics, book, 407.
- clean-up of gases by, 36.
- cold-work, recovery from, *review*, 142.
- corrosion. See *Corrosion*.
- crystals, growth from vapour, 15, 424; hexagonal, 513.
- detection. See *Analysis*.
- development, *review*, 642.
- electrode potential, 239.
- estimation. See *Analysis*.
- extrusion. See *Extrusion*.
- films, transparency in ultra-violet, 276.
- history, 731.
- ignition temperature, 90.
- industry, development in State of Washington, U.S.A., 22; Japanese, 80.
- metallurgy, advances, 80.
- molten, oxide films on, 687.
- oxidation, 515.
- photoelectric properties, 557, 659.
- physical constants, 1.
- polishing. See *Polishing*.
- production, developments, 647; from Washington ores, 129; Russian research, 405; technique, 647.

Magnesium.

- protection, by fluoride coatings, 600; by selenium coatings, 232.
- protective films on, electron diffraction study, 683; study, 232.
- purification by sublimation, 202, 499.
- reaction with nickel & cobalt sulphate solns., 43.
- solubility in magnesium chloride & mixtures of magnesium chloride with potassium chloride & sodium chloride, 577.
- solution by acids, rate, 659.
- specific heat, at higher temps., 561; true, 370.
- statistics, 731, 736.
- sublimation in hydrogen, 15.
- thermal expansion, x-ray detn., 202.
- uses, 731.
- vacuum-distilled, chemical activity, 138.
- vapour pressure, 209, 366, 563.
- welding. See *Welding*.
- Magnesium alloys. See *Alloys*.
- Magnetic after-effect, 460.
- Magnetic hysteresis (see also *Alloys* & under names of metals),
 - apparatus, 27.
 - at low flux densities, 460.
 - curves, apparatus for investigation, 175.
- Magnetic permeability (see also *Alloys* & under names of metals),
 - dispersion in ferromagnetic bodies, theory, 668.
 - of ferromagnetic materials, 6.
 - of superconductors, 144.
- Magnetic properties (see also *Alloys* & under names of metals),
 - and nuclear magnetic moments, 668.
 - at low temperatures, 417.
 - books, 192 (*review*), 195 (*review*).
- Magnetic shields, multi-lamellar cylindrical, shielding ratio, 585.
- Magnetic susceptibility (see also *Alloys* & under names of metals),
 - change during melting & allotropic transformation, 460.
 - definition, 682.
 - relation to elastic stress, 138, 200.
- Magnetic testing. See *Testing*.
- Magnetism, *review*, 566.
- Magnetization (see also *Alloys* & under names of metals),
 - circular, asymmetric rectangular loops associated with, 417.
 - effect of fibrous structure & cooling in magnetic field, 580.
 - mechanical oscillations due to, damping, 212.
 - spontaneous, effect of direction on elect. resistance, 211.
 - thermodynamics, 145.
 - thermoelectric e.m.f. due to, 212.
- Magnetoresistance (see also *Alloys* and under names of metals),
 - 211.
 - discontinuities, 91.
- Magnetoresistance effect, 566.
- Magnetostriction,
 - diamagnetic, 595.
 - review*, 94.

Mallory 3. See *Alloys*.

Mangal. See *Alloys*.

Manganese,

α -, elect. conductivity, 90; properties, 455.

β -, crystal structure, 222, 468; elect. conductivity, 90; properties, 455; Wiedemann-Franz no. at -190°C ., 659.

γ -, elect. conductivity, 90; properties, 455.

amorphous, magnetic properties, 139.

bibliography, 86.

detection. See *Analysis*.

estimation. See *Analysis*.

extraction, book, 82.

hydrometallurgy, book, 82.

industry, 452.

magnetic properties, 139.

minerals, 452.

occurrence, book, 82.

oxidation, rate, 499.

physical properties, book, 82.

production, 558.

properties, 558.

pyrometallurgy, book, 82.

scaling, 499.

separation. See *Analysis*.

statistics, 736.

thermodynamic properties, 43; book, 85.

transformation, 455.

vapour pressure, 209.

Manganese alloys. See *Alloys*.

Manganin. See *Alloys*.

Marine engineers, directory, 332 (*review*).

Mass production, 489.

Materials,

resistance, books, 411 (*review*), 490; exploitation by engineers, 563.

strength, books, 318, 549; theoretical, & practical weakness, 688; theory, 142, 665.

Matteucci effect, 417, 559.

Mechanical properties (see also under specific properties),

at low temperatures, 422.

Mechanical strength, low values, cause, 290.

Mechanical technology, books, 408, 491.

Mechanics of motion, book, 491.

Megapyr. See *Alloys*.

Melting,

advances, 112.

defects, 112.

effect on quality of metal, 716.

electric, book, 491.

furnaces. See *Furnaces*.

vacuum-, 112.

Melting of—

Aluminium, 30, 112, 177; action of fluxes, 534; scrap, 395.

Aluminium alloys, 30, 250, 307.

Brasses, 112, 717; in cupola-type furnace, 622; in gas-fired furnaces, 626; metal losses, 717; scrap, 482; scrap in reverberatory furnace, 72; use of charcoal, 623.

Bronzes, 71, 177, 623; absorption of gases, 623; in cupola-type furnace, 622; use of charcoal, 623.

Melting of—

Calcium-lead-sodium alloys, burning out, effect of addns., 576.

Copper scrap, 72.

Copper alloys, effect of losses on cost, 623.

Copper-nickel alloys (complex), 71; metal losses, 717.

Gilding metal, metal losses, 717.

Lead alloys, burning out, effect of addns., 576.

Magnesium alloys, fluxes, 71.

Manganese-brass, 97.

Manganese-bronze, 97.

Nickel scrap, 252.

Nickel-brasses, 394, 441.

Pewter, 178.

Phosphor-bronze, 177.

Precious metals with gas, 73.

Scrap, 482.

Silicon-brasses, 71.

Silicon-bronzes, 71.

Silumin, 250.

Silver (sterling), 624.

Type metals, 97.

White metals, 625.

Zinc dust, fluxes for, 441.

Zinc-bronzes, 481.

Melting points. See *Alloys & under names of metals*.

Membranes. See *Films*.

Mercury,

adsorbed films on, thickness, 660.

analysis. See *Analysis*.

cathode spot, anchoring, 558.

cathodes, polarization phenomena, 609.

chemical thermodynamics, book, 407.

crystal structure, (liquid & solid), 222; of liquid, near crystn. point, 687.

crystals, diamagnetism, 91.

detection. See *Analysis*.

diffusion in tin, 282.

disperse phase, prodn., 564.

electrode potentials, 704; in liquid ammonia, 704.

entropy, 564.

estimation. See *Analysis*.

evaporation in presence of capillary-active substances, 139.

expansion coefficient of single crystals, 558.

for dental purposes, requirements, 642.

glide-planes in single crystals, 90.

liquid, crystal structure near crystn. point, 687.

parachor, 564.

photochemical reaction with oxygen, 660.

poisoning, 81.

positive ions, action on nickel surfaces, 92.

purification, 43, 532; apparatus, 68.

reflectivity in ultra-violet, 68.

separation. See *Analysis*.

single crystals. See *Single crystals*.

spectra, ultra-violet, 459.

statistics, 736; for 1930-1933, 740.

surface tension, effect of gas adsorption, 659; in presence of dry air, 202; in silica apparatus, 659.

- Mercury**,
 vapour, action on calcium, 138; ad-
 sorption, 81; condensation pheno-
 mena, 91.
 viscosity, 47.
 volatilization through chloride, 502.
 -water interface, 208.
 work-function, relation of field emission,
 202.
- Mercury alloys.** See *Alloys*.
- Mesothorium radiation**, testing metals
 with, 173.
- Metal spraying.** See *Spraying*.
- Metal statistics.** See *Statistics*.
- Metallic state**,
 bibliography, 278.
 electron theory, 93, 143, 278, 279, 370;
 book, 195 (review); of superconduc-
 tion, 568.
 group phenomena, 290.
 magnetic study, 206, 667.
 nature of bond, 46.
 physics, 206.
 quantum theory, 416.
 theory, 206; discussion, 667; reviews,
 513, 667.
- Metallization.** See *Spraying*.
- Metallography** (see also *Photomicrography*),
 books, 191, 489, 545, 549.
 equipment. See *Laboratory apparatus*.
 etching. See *Etching*.
 etching polish, 14, 682.
 mounting of specimens, 343.
 phototechnics, principles, 532.
 progress, 511.
- Metallurgical works**, storage of materials,
 80.
- Metallurgy**,
 ancient, 189, 265.
 applied, 543.
 books, 38, 133, 189, 193 (review), 319,
 409, 544, 650.
 developments, 189.
 early, 37.
 history, 404; book, 269.
 non-ferrous, developments, 80, 452.
 physical, books, 193 (review), 550, 551
 (review).
 research, 317, 405; department, 265.
 teaching, syllabus of City & Guilds of
 London Inst., 740.
 Technical College equipment, 646.
 theoretical, review of literature (1933-
 1934), 142.
- Methyl violet**, adsorption by nickel &
 silver, 203.
- Methylene blue**, adsorption by nickel &
 silver, 203.
- Microphotography.** See *Photomicrography*.
- Microscopes.** See *Laboratory apparatus*.
- Microscopy** in foundry practice, 585.
- Milk**,
 action on metals. See *Corrosion*.
 coagulation with rennet, effect of mate-
 rial of container, 404.
 condensed, effect of metals on flavour,
 317.
- Milling of—**
 Aluminium & its alloys, 75, 446.
 Monel metal, 633.
- Mineral industry**, book, 131.
- Mines**, Roman, in Europe, book, 407.
- Mixed crystals.** See *Alloys: Solid solu-
 tions*.
- Modification.** See *Alloys*.
- Molecular weights.** See under names of
 metals.
- Molecules**, binding forces, 289.
- Molten metals** (see also under names of
 metals),
 adsorption of gases, review, 665.
 electrical resistance, change in magnetic
 field, 668.
 Mott theory, 370.
 non-metallic inclusions, flotation, 220.
 oxide films, electron diffraction study
 99.
 removal of deoxidation products, 716.
 tarnishing, x-ray study, 687.
 viscosity, measurement, 47.
 x-ray dispersion, 57.
- Molybdenum**,
 adsorbed atoms on, migration on surface,
 210.
 bars, from pressed powder, 258.
 casting. See *Casting*.
 chemistry, book, 324 (review).
 crystals, deformed, change in intensity of
 x-ray reflection, 425.
 diffusion of hydrogen, 563, 665.
 diffusion of nitrogen, 563, 665.
 electron emission, 681.
 estimation. See *Analysis*.
 ferro-. See *Alloys: Ferro-molybdenum*.
 heat of relaxation from recrystn. data,
 563.
 hot surfaces, ionization of potassium on,
 91.
 in electrical industry, 633.
 ionization of alkali metal atoms on, 205.
 metallographic etching, 682.
 optical constants, 4.
 properties, 403.
 separation. See *Analysis*.
 sintering of pressed powder, 258.
 soldering. See *Soldering*.
 specific heat at high temps., 275.
 statistics, 736, 740.
 superconductivity, 275.
 temperature scales at $0.667\ \mu$, 621.
 thermionic constant A , apparent, 662.
 total radiation, effect of sand-blasting
 334.
 uses, 403.
- Molybdenum alloys.** See *Alloys*.
- Monel metal.** See *Alloys*.
- Mosaic structure.** See *Crystals*.
- Moulding** (see also *Casting, &c.*),
 machines, 178.
 sands. See *Refractory materials*.
- Moulding of—**
 Aluminium casing with sand core &
 iron shell, 262.
 Aluminium-bronze, 30.
 Coloured alloys, book, 546.
 Propellers, 307, 308.
- Moulds**,
 capacity of alloys to reproduce shape,
 621.
 drying, 308, 394.

- Moulds**,
for plastic materials, elect. manuf., 388.
for thin-walled, complicated castings, design, 535.
- Mumetal**. See *Alloys*.
- N.A. alloys**. See *Alloys*.
- Native metals**. See under names of metals.
- Naval machinery**, appn. of metals, 37.
- Neodymium**,
detection. See *Analysis*.
production, 199.
pure, prepn., 141.
- Neodymium alloys**. See *Alloys*.
- Nichrome**. See *Alloys*.
- Nickel**,
absorption of hydrogen, 274, 660.
action of nitrogen, 209.
action of printed labels, 18.
adhesives &, strength of joints, 173.
adsorption of hydrogen, 274.
adsorption of methyl violet, 203.
adsorption of methylene blue, 203.
anodes, selection, 350.
atomic heat at low temps., 274, 558.
catalytic activity, change near Curie point, 660.
cementation. See *Cementation*.
chemical thermodynamics, book, 407.
-clad steel, 697.
cold-work, recovery from, review, 142.
cold-worked, lattice distortion, 593; x-ray line sharpness, relation to high-temp. stability, 16.
colouring. See *Colouring*.
compounds, uses in metal finishing, 64.
cooking utensils, behaviour, 79.
corrosion. See *Corrosion*.
creep, 93.
crystal lattice distortion, 593.
crystal orientation in castings, 455.
deformation resulting from heat-treatment, 461.
deposition. See *Deposition*.
deposits, "burning," 526; corrosion. See *Corrosion*; protective value, 20, 82, 232; structure, 590; structure, relation to chem. & phys. properties, 469, 683.
detection. See *Analysis*.
diffusion through molybdenum, 563.
diffusion of hydrogen, 139, 563, 665.
effect of foods, 79; bibliography, 79.
electrical resistance, 502; dependence on temp. at Curie pt., 499; effect of direction of spontaneous magnetization, 211.
electron diffraction patterns, 224, 591.
estimation. See *Analysis*.
ferromagnetic transformation, volume change accompanying, 44, 91.
films, density, 499; elect. conductivity, 499; electron diffraction patterns, 225; sputtered, threshold value, 564; x-ray index of refraction, 499.
finishing, 484.
fogging, 18.
fuse wire, melting time, 644.
- Nickel**,
grinding. See *Grinding*.
gyromagnetic effect above Curie point, 559.
heat of relaxation from recrystn. data, 563.
history, 318.
hot surfaces, action of caesium positive ions, 91.
in canning equipment, 102.
in caustic processing equipment, 450.
in chemical plant, 645.
in crude oil refining, 451.
in dairy, 542, 645.
in dentistry, 79.
in electrical industry, booklet, 545.
in food industries, 736.
industry in 1935, 127.
internal stresses produced by cold-work, 593.
length variation on quenching, 366.
magnetic properties, near Curie point, 558; of deposits (by various processes), 136.
magnetic susceptibility, dependence of frequency, 202.
magnetic transformation of heavily cold-worked, 4.
magnetization, change in thermal energy accompanying, 139.
magnetoresistance, & magnetic structure, 211; at low & high temps., 137, 198; discontinuities, 91; in single crystals, 91.
matrices, elect. prodn., 21.
Matteucci effect, 559.
melting. See *Melting*.
metallurgy, advances, 80.
odour, 48.
oxidation, 294, 516, 597.
oxide-coated, thermionic emission, effect of impurities in core-metal, 414.
paramagnetism, 660.
photoelectric thresholds in turned state, 93.
-plated articles, action of printed labels, 18.
polished surfaces, structure, 590.
polishing. See *Polishing*.
powder, adsorption of hydrogen, ethane, & ethylene, 502; lattice distortion, 592.
printed matter for, pamphlet, 85.
purification, 716.
recovery from cold-work, 414.
reduced, adsorption of hydrogen, 139.
refining. See *Refining*.
reflectivity, in region 300-186 μ , 564; ultra-violet, 416.
rigidity coeff., effect of magnetization, 43.
rolling texture, 686.
Russian plant, 488.
scrap, remelting & refining, 252.
secondary electron emission, produced by caesium positive ions, 91; produced by mercury positive ions, 92.
separation. See *Analysis*.
single crystals. See *Single crystals*.
soldering. See *Soldering*.
sources, 736.

- Nickel**,
 specific heat, true, 370; true, temp. coeff., 91.
 statistics, 318.
 taste, 48.
 technology, 736.
 thermal conductivity, effect of cold-work, 277.
 thermal expansion, 43, 44, 91.
 thermionic work-function, 274.
 thermomagnetic hysteresis, 456.
 total radiation, effect of soot covering, 334.
 uses, 316, 736 (see also entries above).
 viscous deformation of wires, 139.
 volume change accompanying ferro-magnetic transformation, 44, 91.
 welding. See *Welding*.
 wires, adsorption of dyes, 499; highly drawn, validity of Becker's relation for initial permeability, 558; magnetic effect on Pirani gauges using, 660; viscous deformation, 139.
 x-ray dispersion, 456.
Nickel alloys. See *Alloys*.
Nickel-clad. See *Nickel*.
Nimol. See *Alloys*.
Niobium,
 analysis. See *Analysis*.
 atomic weight, 497.
 chemical properties, 199.
 deposition. See *Deposition*.
 electrolytic valve action, 334.
 history, 199.
 occurrence, 199, 663.
 physical properties, 199.
 properties, review, 663.
 separation. See *Analysis*.
 specific heat at high temps., 275.
 statistics, 738, 740.
 temperature scales, at 0.667 μ , 621.
 uses, 199, 663.
Niobium alloys. See *Alloys*.
Ni-Resist. See *Alloys*.
Nitric acid, corrosion by. See *Corrosion*.
Nitrides. See *Alloys & compounds*.
Nitriding, effect on metals, 209.
Nitrocellulose solutions, corrosion by. See *Corrosion*.
Nitrogen (see also *Gases*),
 absorption by iron-molybdenum alloys, 151.
 action on metals, elect. discharges at low pressures, 276.
 adsorption by cobalt, 199.
 diffusion through molybdenum, 665.
 industry, materials for, review of literature, 645.
Nitroglycerin, action on metals. See *Corrosion*.
Nitrose, corrosion by. See *Corrosion*.
Non-ferrous metals & alloys,
 handbook, 133 (review).
 past & future, 80.
 uses, book, 650.
Non-metallic inclusions in molten metals, flotation, 220.
Notches, effect on properties of metals, 5.
Nöral. See *Alloys*.
 Odour of metals, 48.
Oil-fired furnaces. See *Furnaces*.
Oil industry,
 calorized tubes for, tests, 696.
 corrosion prevention by use of ammonia, 697.
 sucker rods, materials for, 696.
Oils, corrosion by. See *Corrosion*.
Oleic acid, boiling, resistant material, 17.
Olivine. See *Refractory materials*.
Optical properties (see also *Alloys & under names of metals*),
 of thin films, 48.
 theory, 502.
Ores. See under names of metals.
Osmiridium. See *Alloys*.
Osmium (see also *Platinum metals*),
 analysis. See *Analysis*.
 detection. See *Analysis*.
 uses, 737.
Ounce metal. See *Alloys*.
Overvoltage (see also under names of metals),
 hydrogen-, cause, 240.
 theory, 240.
Oxalic acid, corrosion by. See *Corrosion*.
Oxidation (see also *Corrosion, Alloys, & under names of metals*),
 anodic. See *Anodic oxidation*.
 electron diffraction study, 59.
 of boiler tubes, prevention by metal spraying, 603.
 of heated solid metals, book, 652 (review).
 of wires, kinetics, 597.
 prevention, methods, 696.
 surface, 294.
Oxide films. See *Films*.
Oxides. See *Alloys & compounds & also Refractory materials*.
Oxy-acetylene flame, uses, pamphlet, 130.
Oxygen (see also *Gases*),
 absorption, by molten copper, review, 665; by molten silver, review, 665.
 adsorption, by platinum, 560, 660; by tungsten, 560.
 in metallurgy, 740.
 solubility in cobalt, 555, 656.
Ozone, effect on metals, 19.
- P.M.G. alloy**. See *Alloys*.
Packing, metallic, 488.
Painting, preparation of surface, 105.
Painting of—
 Aluminium, 21, 105.
 Aluminium alloys, 1, 21.
 Galvanized iron, 105, 297.
 Magnesium alloys, 1, 472.
 Tungum, 105.
 Zinc, 105.
Paints,
 aluminium. See *Aluminium*.
 anticorrosive, 386, 523.
 book, 491.
 for water tank interiors, 700.
 priming, metallic, 234.
 protective, from coal-tar or coal-tar oil, 298.
 protective value, 523.
 standards, A.S.T.M., book, 647.

- Paints,**
temperature-recording, 176.
Ultra Fuson, 234.
- Palladium** (see also *Platinum metals*),
absorption of hydrogen, 499, 559, 660.
adsorption of hydrogen in presence &
absence of water, 559.
annealing. See *Annealing*.
assay. See *Analysis*.
catalytic properties, 4.
cold-work, recovery from, review, 142.
detection. See *Analysis*.
diffusion of deuterium, 559.
diffusion of hydrogen, 203, 366, 367,
559; mechanism, 560.
estimation. See *Analysis*.
evolution of hydrogen, rôle of inter-
granular fissures, 456.
hydrogen-charged, action of external
elect. field, 4.
hydrogen-saturated, lattice const., 100.
in dentistry, 79.
lattice constants (satd. with hydrogen),
100.
occlusion of hydrogen, rôle of inter-
granular fissures, 456.
permeability to hydrogen, 560.
photoelectric effect, 140.
preparation, 456.
properties, 456.
separation. See *Analysis*.
specific heat, 4.
tensile properties, effect of annealing,
140, 660.
triboelectric effect, 140.
uses, 456, 737.
- Palladium alloys.** See *Alloys*.
- Palmitic acid,** boiling, resistant material,
17.
- Panphot.** See *Laboratory apparatus*.
- Pantal.** See *Alloys*.
- Paper industry,** metals & alloys for, 543.
- Paramagnetism.** See under names of
metals.
- Parkerizing,** 232.
- Passivity** (see also under names of metals),
anodic, 3, 276.
bibliography of text-books, 39.
potentiometric study, 240.
theory, 230, 499, 528.
- Patents,** index (U.S.A.), book, 40.
- Patina.** See under names of metals.
- Patternmaking,** 308.
book, 40 (*review*).
- Peltier coefficient,** direct measurement, 417.
- Peltier effect,** 564; see also under names
of metals.
- Peraluman.** See *Alloys*.
- Percentages,** weight % mol. % nomograph,
189.
- Periodicals,** subject index, 649.
- Permalloy.** See *Alloys*.
- Permatherm.** See *Alloys*.
- Perminvar.** See *Alloys*.
- Petrolatum,** protective value, 233.
- Petroleum plant,**
calorized pipe-still tubes for, tests, 696.
corrosion. See *Corrosion*.
materials for, 738.
sucker rods, materials for, 696.
- Petrols** (see also *Liquid fuels*),
corrosion by. See *Corrosion*.
corrosivity, testing, 295, 296.
- Pewter.** See *Alloys*.
- Phase boundaries.** See *Alloys*.
- Phase diagrams.** See *Equilibrium dia-
grams*.
- Phenol,** boiling, resistant material, 17.
- Phosphides.** See *Alloys*.
- Phosphor-bronzes.** See *Alloys*.
- Phosphoric acid,** corrosion by. See *Cor-
rosion*.
- Phosphorus,** estimation. See *Analysis*.
- Photo-elastic phenomenon,** optical creep
&, 355.
- Photoelectric cells.** See *Laboratory appar-
atus*.
- Photoelectric effect** (see also under names of
metals),
spectral selective, theories, 93.
- Photoelectric thresholds** of turned surfaces,
93.
- Photoelectronic effect** of incandescent
metals, 564.
- Photomicrographs,** interpretation, 585.
- Photomicrography** (see also *Metallography*),
equipment. See *Laboratory apparatus*.
with long-wave light, 245.
- Photo-resistance,** 48.
- Photo-voltaic effect,** effect of polarization,
564.
- Physical properties** (see also under specific
properties),
book, 271 (*review*).
- Physics,**
book, 195 (*review*).
constants, book, 546.
international conference, report, 324
(*review*).
low-temperature, book, 135 (*review*).
nomenclature, book, 324 (*review*).
nuclear, book, 324 (*review*).
of metals, book, 271 (*review*).
progress, book, 196 (*review*).
symbols & units, book, 324 (*review*).
- Pickling,**
adsorption of hydrogen, review, 665.
baths, acid, 539; regeneration, 259.
Bullard-Dunn process, 311.
Ferrolite process, 311.
Hanson Munning process, 311.
hydrogen ion concentration of saliva of
picklers, 311.
Madsenell process, 311.
problems, discussion, 182.
reactions, 361.
review, 298.
vapours, removal, 311.
- Pickling of—**
Castings in hydrochloric acid, 182.
Duralumin, effect on fatigue strength,
8.
- Piobert effect,** 664.
- Pipes** (see also *Tubes*),
cold-water service, minimum specifica-
tions, 408.
corrosion. See *Corrosion*.
materials, development, 126.
transport of materials in, history, 405.
water-circulating, 452.

- Pirani gauges**, using nickel wires, magnetic effect, 660.
- Pistons**, automobile, temp. measurements, 619.
- Plastic deformation** (see also *Deformation, Drawing, Rolling, &c.*),
book, 409.
effect on mechanical strength, 290.
mechanism, 207.
method of study, 562.
of crystals, 47, 369.
reviews, 538, 629, 723.
structure changes, x-ray study, 57.
theory, 47, 273.
- Plastic flow**,
beginning, 246.
resistance to, effect of fluid pressure, 335.
- Plasticity** (see also *Alloys & under names of metals*),
definition of term, 110.
heightening under alternating plastic torsion, 207, 664.
of crystals, 273, 290, 664; book, 323 (review); effect of temp., 562; theory, 335, 594.
relation to cohesion, 175, 533.
theory, 664, 665.
- Plating**. See *Deposition*.
- Platinum** (see also *Platinum metals, Precious metals, &c.*),
action of helium, 274.
action of hydrogen, 274.
action of oxygen under elect. discharge, 274.
adsorption of hydrogen, 660.
adsorption of oxygen, 560, 660.
affinity for phosphorus, 510.
analysis. See *Analysis*.
annealing. See *Annealing*.
anodic polarization in 2*N*-sulphuric acid, 499.
assay. See *Analysis*.
buffing. See *Buffing*.
catalytic activity, 661.
cold-work, recovery from, review, 142.
deposition. See *Deposition*.
detection. See *Analysis*.
disperse phase, prodn., 564.
electrode dispersion, 608.
electrodes, effect of H.-F. currents, 704.
electron diffraction patterns, 224.
estimation. See *Analysis*.
extraction, 262.
films, effect of light on elect. resistance, 48; elect. conductivity in electrostatic field, 210.
fuse wire, melting time, 644.
gauze, corrosion-resistance, effect of rhodium, 510.
heat of relaxation from recrystn. data, 563.
history, 262.
in dentistry, 79.
industry in 1935, 127.
isotopes, 456.
metallurgy, book, 266.
occurrence, 262.
passivity, 499.
- Platinum**,
photoelectric effect, effect of gases, 560.
photoelectric emissivity, effect of adsorbed gases, 560.
reaction between carbon dioxide & hydrogen on, kinetics, 661.
recrystallization of sponge, 101.
refining. See *Refining*.
separation. See *Analysis*.
tensile properties, effect of annealing, 140, 660.
thermal expansion, x-ray detn., 208.
thermionic emission in bromine & chlorine vapours, 367.
thermoelectric homogeneity of wire, 44.
uses, 737.
- Platinum alloys**. See *Alloys*.
- Platinum black**, prepn., 203.
- Platinum metals** (see also under names of platinum metals),
bibliography, 736.
detection. See *Analysis*.
properties, review, 643.
separation. See *Analysis*.
statistics, 736.
- Platnam**. See *Alloys*.
- Plumber's metal**. See *Alloys*.
- Plumbism**. See *Lead, poisoning*.
- Plumrite**. See *Alloys*.
- Pobedit**. See *Alloys*.
- Polarization** (see also under names of metals),
anodic, in aqueous solns., limiting current, 61, 230.
cathodic, 240.
- Polished surfaces** (see also under names of metals),
amorphous layer, thickness, 288, 468.
examination, 438.
structure, 156, 224, 288, 468, 590.
tarnishing, measurement, 19.
- Polishes**, metal, 539.
- Polishing** (see also *Buffing*),
barrels, 634.
books, 134 (review), 545, 653 (review).
economical, 726.
pastes, 484.
review, 634, 726.
- Polishing of—**
Aluminium, 312, 361, 634.
Aluminium alloys, 361, 634.
Automobile bumpers, 301.
Copper, 312, 634.
Copper alloys, 634.
Light metals, 634.
Magnesium, 312.
Monel metal, 484.
Nickel, 259.
Nickel alloys, 259.
Tinplate, 312.
- Polonium**,
deposition. See *Deposition*.
electrode potential, 609.
estimation. See *Analysis*.
- Polymorphic transformations** (see also under names of metals),
rate, 415.
review, 92.
- Polynary alloys**. See *Alloys*.

- Porosity** (see also *Alloys* & under names of metals),
in castings, 307.
- Potash industry**, corrosion in. See *Corrosion*.
- Potassium** (see also *Alkali metals*),
atomic weight, 500.
compressibility, 562.
detection. See *Analysis*.
electrical resistance, effect of pressure, 274.
electrode potentials in liquid ammonia, 704.
entropy, 564.
estimation. See *Analysis*.
films, energy distribution of photoelectrons as function of thickness, 44; (evapd.) on silicon, photoelect. properties, 203.
Hall effect, 140.
ionization on hot molybdenum surfaces, 91.
lattice constant, 562.
lattice energy, 562.
molecular weight, 54.
molten, change of elect. resistance in magnetic field, 668.
parachor, 564.
thermal ionization from tungsten & molybdenum, 205.
thermoelectric force, 456.
viscosity, 141, 498.
volume changes, effect of pressure, 274.
- Potassium alloys**. See *Alloys*.
- Potentials**, electrode. See *Electrode potential*.
- Potentiometers**. See *Laboratory apparatus*.
- Pounding tests**. See *Alloys: Bearing alloys, &c.*
- Pouring**. See *Casting*.
- Powdered metals** (see also *Alloys* & under names of metals),
adsorption of gases, 556.
adsorption of hydrogen, ethylene & ethane, 502.
bibliography, 258.
diamagnetism, 565.
fineness, detn., 488.
in hard metal production, 543.
manufacture, 258; Hametag process, 258.
metallography, review, 585.
preparation, 502.
pressed, developments in 1934, 359; elect. conductivity, 6; hardening effects, 6.
sintering, 148, 181.
uses, 258.
- Powders**, x-ray reflections, detn. of intensity, 27.
- Power transmission**, directory, 321.
- Praseodymium**, detection. See *Analysis*.
- Praseodymium alloys**. See *Alloys*.
- Precious metals** (see also under names of precious metals),
as constructional materials, 737.
detection. See *Analysis*.
industry in 1935, 127.
melting. See *Melting*.
- Precious metals**,
refining. See *Refining*.
residues, elect. recovery, 179.
rinsing tanks, losses, 114.
testing, book, 494 (*review*).
- Precious metal alloys**. See *Alloys*.
- Precipitation-hardening**. See *Age-hardening*.
- Presses**, power, safety precautions, pamphlet, 190.
- Pressing**,
cold-, 360; bibliographies, 630; general discussion, 630; metallurgical aspects, 630; tests for sheet materials, 630.
safety devices, book, 740 (*review*).
- Pressing of—**
Aluminium, power consumption, 629.
Aluminium alloys, 117.
Anticorodal, power consumption, 629.
Brasses, book, 411 (*review*).
Duralumin, power consumption, 629.
Peraluman, power consumption, 629.
Tinplate containers, 538.
- Pressure die-casting**. See *Die-casting*.
- Propellers**,
aircraft. See *Aircraft*.
casting. See *Casting*.
cavitation, 347.
manufacture, 307, 308, 481.
materials for, 506.
moulding. See *Moulding*.
- Protalizing**, 232.
- Protection of metals & alloys**, 20, 61, 103, 163, 231, 296, 348, 385, 430, 472, 519, 599, 695; see also under various methods, e.g. *Anodic Oxidation, Coloring, Deposition, Galvanizing, Painting, Spraying, Tinning, &c.*
against corrosion, 348; by derived (indirect) electrolytic actions, 232; electrochem. methods, book, 412 (*review*).
bibliography of text-books, 39.
by chemical deposits, 232.
by coatings, 599.
- Pyrometers** (see also *Thermocouples*),
Ardometer, 29.
compensating leads, 249.
for very hot gases, 29.
indicating, 357.
optical, cross-filament, 620; disappearing-filament, 620; fundamental reference point, 440; partial radiation, 620; precision, 250; Pyro triple range, 357.
- Ovenograph**, 250.
- pivoting systems**, 393.
- pneumatic**, 29.
- thermoelectric**, installation & maintenance, 481; use & care, 481.
- Pyrometry**, International temperature scale, 440.
- Quaternary alloys**. See *Alloys*.
- Quenching** (see also *Heat-treatment*),
media, behaviour, 309.
oils, booklet, 38.
- Quicksilver**. See *Mercury*.

- R.R. alloys.** See *Alloys*.
Radio-chemistry, 23.
Radiology.
 absorption method, 514.
 apparatus, portable, 249.
 application of mesothorium, 173.
 application of x-rays, 225, 480.
 applications, 440.
 books, 266, 653 (*review*).
 by secondary x-rays, 713.
 in works' laboratories, rôle, 380.
 Localisator, 111.
 of fine flaws, 439.
 practical, 247.
 Röntgen & his discoveries, booklet, 83.
Radiology of—
 Castings, routine, 111.
 Gas-welded copper loco. fireboxes, 111.
 Magnesium castings, 247.
 Welds, 439, 480, 716.
Radium,
 bibliography, 737.
 detection. See *Analysis*.
 statistics, 737.
 uses, 737.
Rare earth metal salts, electrolysis. See *Electrolysis*.
Rare earth metals (see also under names of rare earth metals),
 bibliography of text-books, 39.
 estimation. See *Analysis*.
 occurrence, 663.
 preparation by thermal dissociation of amalgams, 141.
 properties, *review*, 663.
 separation. See *Analysis*.
 statistics, 738.
 uses, 663.
Rare metals (see also under names of rare metals),
 industry, U.S.A., 740.
 statistics, 80, 740.
Rayon industry,
 corrosion in. See *Corrosion*.
 prevention of corrosion in, 696.
Recrystallization (see also *Alloys*, under names of metals, & also *Crystals, growth*),
 accompanying allotropic change, 684.
 effect of heating time, 369.
 function of recovery, *review*, 99.
 growth of new grains, anisotropic rate, 220.
 in cold-worked metals, 587, 684.
 mechanism, model substances for elucidating 142; *review* of work on rock-salt, 142.
 nature, 56, 587.
 nucleus formation during, 684.
 texture. See *Alloys* & under names of metals.
 theory, 343.
Rediffal. See *Alloys : Solders*.
Refining of—
 Aluminium, 365, 388, 497.
 Cadmium, electro-, *review*, 702.
 Copper, electro-, *review*, 702.
 Copper-silver alloys, electro-, 609.
 Gold, 262, 641; electro-, *review*, 702.
 Jewellery scrap, electro-, 609.
Refining of—
 Lead, by evaporation in high vacuum, 475; use of pure oxygen, 435.
 Nickel scrap, 252.
 Platinum, 262.
 Precious metals, book, 411.
 Precious metal alloys, electro-, 609.
 Silicon-brasses, 535; bibliography, 535.
 Silicon-bronzes, 535; bibliography, 535.
 Silver, electro-, *review*, 702.
 Silver alloys contg. palladium, electro-, 610.
 Tin, by evaporation in high vacuum, 475; electro-, 23; electro-, *review*, 702.
 Zinc, electro-, *review*, 702.
Reflection, metallic, quantum theory, 380.
Reflectivity (see also *Optical properties, Alloys*, & under names of metals),
 measurement, 616; meter for, 739.
 of thin films, 48.
- REFRACTORY MATERIALS.**
 bricks, reaction temps. of various types, 722; shape, 255.
 cements, 115, 628; compn. & properties, 722.
 compressive strength, relation to porosity, 115.
 cracking, 722.
 crucibles, graphite, German, 628; thorium oxide, 628.
 effect of hydrogen, 444.
 effect of natural gas, 444.
 electric furnace linings, 628, 721; in brass industry, 628.
 equilibrium diagrams, 131, 444.
 for copper-refining furnaces, 309.
 for furnaces, requirements, 722.
 for non-ferrous industry, 115.
 for white-metal furnaces, 483.
 foundry, 359, 628, 721.
 furnace linings, ramming, 254.
 fused, effect of variations in alumina-silica ratio on resistance to metal oxides, 443.
 gas-permeability, 722; measurement, 722; relation to porosity, 115.
 heat capacity, relation to porosity, 115.
 heat-flow, 443.
 in foundry, 721.
 in metallurgy, 720.
 industry, American, directory, 189; Russian, 116.
 insulating, 443, 721.
 overheating, 722.
 packing, 31.
 permeability to hydrogen at high temps., 722.
 porosity, effect on properties, 115; rapid detn., 538.
 properties, *review*, 721; tables, 722.
 pyrometric cone equivalent, variations after re-heating at elevated temps., 537.
 siliceous, analysis, 444.
 slag corrosion, testing, 256.
 spalling, A.S.T.M. panel test, 115; relation to porosity, 115.
 special, characteristics, 538; development, 721.

Refractory materials—

- splintering, 444.
- standards, 483; A.S.T.M., book, 189.
- super-, 115.
- terms relating to, A.S.T.M. definitions, 115.
- testing, 256.
- thermal conductivity, 443; measurement, 443, 444; measurements, reliability, 628; relation to porosity, 115.
- thermal expansion, relation to porosity, 115; table, 722.
- uses, 722; review, 721.

Alumina, crucibles, 309; crucibles & tubes, porosity, method for decreasing, 359; fused, properties, 628; sintering behaviour, 255.

Alumino-silicate bricks, properties, 359.

Chromite bricks, characteristics, 538.

Corundum, characteristics, 538.

Firebricks, manuf., difficulties, 395; porosity, reduction, 359, 360.

Fireclay, ground, A.S.T.M. specifications, 115.

Fireclay bricks, iron oxide in, 255, 256; spalling, 723; volume stability, 255.

Graphite, crucibles, German, 628; thermal expansion, pamphlet, 84.

Magnesite, analysis, A.S.T.M. method, 115; iron content, 255; statistics, 736.

Moulding sands, brass foundry problems, 394, 625; circulation in foundries, 625; cohesion, effect of chem. compn. of colloids, 536; control, 179; detn. of moisture, 482; effect of clay & water, 113; fineness testing, comparison of methods, 113; fineness testing, use of pipette method, 178; flowability, 625; moist, strength test, 113; permeability testing, 179; properties, factors influencing, 71; specifications of U.S. Naval Gun Factory, 625; synthetic, 308; testing, 113, 395.

Olivine, pamphlet, 84.

Oxides, compn.-temp. phase equilib. diagra., 131.

Silica bricks, improvement, 256; quartz sand in, 395.

Silicon carbide, characteristics, 538; properties, 628.

Sinterkorund, properties, 73, 180; uses, 73.

Thorium oxide, crucibles, small, 628.

Zirconia, characteristics, 538; crystal modifications, 723.

Reinite. See *Alloys*.

Research,

- as factor in competition, 489.
- book, 406.
- in engineering, 489.
- library of Standard Oil Development Co., 488.
- metallurgical, 37, 317, 405.

Resistance, electrical. See *Electrical resistance*.

Resistance of materials. See *Materials*.

Rhenium,

- deposition. See *Deposition*.
- estimation. See *Analysis*.
- literature, review, 200.
- occurrence, 663.
- optical constants, 657.
- properties, review, 663.
- separation. See *Analysis*.
- statistics, 738, 740.
- uses, 663.

Rhodium (see also *Platinum metals*),

- analysis. See *Analysis*.
- assay. See *Analysis*.
- deposition. See *Deposition*.
- detection. See *Analysis*.
- estimation. See *Analysis*.
- freezing point, pamphlet, 85.
- reflectivity, ultra-violet, 416.
- temperature scales at 0.667 μ , 621.
- uses, 737.

Rhodium alloys. See *Alloys*.

Rigidity. See *Alloys* & under names of metals.

Rinsing tanks, losses in precious metals industry, 114.

Riveting of—

Aluminium structures, 32, 33.

Aluminium alloys, 33.

Duralumin, 33; improvement, 32.

Rock-salt, structure-sensitive properties, 291.

Rods, non-magnetic, frequency of longitudinal vibration, 667.

Rolling,

books, 130, 269.

cold-, of flat stock, 257; roll pressure, 483; safety appliances, 631.

data, graphical computation, 484.

effect of lubrication, 631.

flow of metals, effect of friction, 31.

hot-, discussion, 631; of flat stock, 257.

roll pressure, 483; autographic apparatus for indicating, 257.

Rolling mills,

bearings, composite, 74.

cold-, drive, 723.

developments in Germany, 31.

electric drive, 723.

for thin sheet, 632.

lead, 257.

Rolling of—

Aluminium, effect of friction on flow, 31; lubricants, 32.

Aluminium alloys, 117, 118.

Bimetal, hot-, 483.

Brasses, book, 411 (*review*); hot-, resistance to deformation, 631; sheet, effect of mill variables on gauge, 32, 181.

Copper, effect of friction on flow, 31; wire, grooving & power consumption, 632.

Lead, effect of friction on flow, 31.

Pewter, 178.

Sheet, effect of roll diam., 360.

Silver, faults, 631.

Wire, calibration of rolls, 484.

Zinc sheets, 483.

- Rolling texture (see also *Alloys* & under names of metals),
x-ray analysis, review, 224.
- Rolls, grooves, roughing, 74.
- Röntgen analysis. See *Crystal structure*.
- Rubber coatings for corrosion prevention, 605.
- Rubidium (see also *Alkali metals*),
atomic weight, 661.
detection. See *Analysis*.
estimation. See *Analysis*.
molecular weight, 54.
occurrence, 663.
properties, review, 663.
thermoelectric force, 456.
uses, 663.
- Rubidium alloys. See *Alloys*.
- Rupture, conditions of, 666.
- Russia. See *Union of Soviet Socialist Republics*.
- Ruthenium (see also *Platinum metals*),
detection. See *Analysis*.
separation. See *Analysis*.
uses, 737.
- SSZ alloys. See *Alloys*.
- Salt refining, metals for use in, 405.
- Samarium (see also *Rare earth metals*),
pure, prepn., 141.
separation. See *Analysis*.
- Samarium alloys. See *Alloys*.
- Sampling. See *Analysis*.
- Sand-blasting, 182, 633.
health hazards, 485.
- Sands, moulding. See *Refractory materials*.
- Satco metal. See *Alloys*.
- Sawing, performance of cutting fluids, 75.
- Sawing of—
Aluminium & its alloys, 446.
- Saws, circular, breakage, 726.
- Scaling (see also under names of metals),
of heated solid metals, book, 652 (review).
- Science, book, 492.
- Scotland. See *Great Britain*.
- Scrap (see also *Secondary metals*, *Alloys*, & under names of metals),
classification, 442.
disposal, in U.S.A., 442.
melting. See *Melting*.
- Screens. See *Sieves*.
- Season-cracking (see also *Internal stress*, & under *Alloys* & names of metals), 422.
bibliography, 663.
determination of intensity & distribution, 663.
- Sea-water, corrosion by. See *Corrosion*.
- Secondary metals (see also *Scrap*, *Alloys*, & under names of metals),
industry, in 1935, 127.
metallurgy, book, 548.
- Secondary structure. See *Crystals*.
- Segregate structures. See *Widmanstätten structure*.
- Segregation. See *Inverse segregation* & *Alloys*.
- Selenium,
detection. See *Analysis*.
diamagnetism, anomalous, 661.
electrical conductivity, effect of temp., 204.
- Selenium,
estimation. See *Analysis*.
films, crystalline, structure, 591.
magnetic susceptibility of powders, variation with particle size, 565.
occurrence, 663.
properties, review, 663.
separation. See *Analysis*.
single crystals. See *Single crystals*.
statistics, 738, 740.
uses, 663.
vitreous, transition to metallic form, 223.
- Semi-conductivity, Wilson's theory, 141.
- Semi-conductors, solid, theory of Dember & Kikoin-Noskov effects, 668.
- Separation. See *Analysis*.
- Shear, permanent deformation by, effect of fluid pressure, 335.
- Shear strength. See *Alloys* & under names of metals.
- Sheets (see also *Alloys* & under names of metals),
brittleness, 74.
classification by gauge, machine, 484.
gauge, 617.
perforated, stresses, book, 39.
rolling. See *Rolling*.
scissors, 483.
testing. See *Testing*.
tolerances, 264.
working, book, 648.
- Shipbuilders, directory, 332 (review).
- Shipbuilding, materials for, 543, 739.
- Shipowners, directory, 332 (review).
- Shock, resistance to, of 37 metals & alloys, 369.
- Shrink fits, frictional resistance, 97.
- Sieves, smooth, electrodeposited, 543.
- Silica. See *Refractory materials*.
- Silicides. See *Alloys* & compounds.
- Silicon,
as alloying element, 10.
conduction electrons, 41.
estimation. See *Analysis*.
optical constants, 41.
oxidation, 414; at low temps., 44.
purification by sublimation in vacuum, 2, 454.
vapour pressure, 209.
- Silicon alloys. See *Alloys*.
- Silicon carbide. See *Refractory materials*.
- Silit heating elements, max. load, 255.
- Silumin. See *Alloys*.
- Silver (see also *Precious metals*),
absorption of oxygen, review, 665.
action of nitrogen at low pressures, 276.
adsorption of methyl violet, 203.
adsorption of methylene blue, 203.
analysis. See *Analysis*.
bactericidal action, 187, 263, 316, 403, 643.
bibliography, 735.
boiling point, 502.
casting. See *Casting*.
cleaning. See *Cleaning*.
coins, copper-coated, from Cyprus, 18.
cold-work, recovery from, review, 142.
compressibility, 416.
corrosion. See *Corrosion*.
creep, 93.

Silver,

- deoxidation. See *Deoxidation*.
- deposition. See *Deposition*.
- deposits, structure, relation to chem. & phys. properties, 469, 683.
- detection. See *Analysis*.
- diffusion of positive ions of salts at high temps., 556.
- disperse phase, prodn., 564.
- effect of ozone, 19.
- electrode potentials in liquid ammonia, 704.
- electron diffraction patterns, 224, 591.
- estimation. See *Analysis*.
- films, effect of light on elect. resistance, 48; elect. resistance, 140, 500; on nickel, photoelect. effect, 661; reflectivity, 48, 140, 500, 564; scattering of light, 336; sputtered, crystn., 287; sputtered, structure & phys. properties, 590; transformation from amorphous to crystalline state at low temps., 140, 500; transparency in ultra-violet, 276.
- fuse wire, melting time, 644.
- gases in, 716.
- hall-marking, law & practice, book, 653 (review).
- heat of relaxation from recrystn. data, 563.
- in chemical industry, 263, 451; review of literature, 643.
- in food industry, 263.
- industry in 1935, 127.
- lattice parameters, effect of addns., 424.
- magnetic susceptibility, change, 460; of powders, variation with particle size, 565.
- mean free path of electrons, 367.
- melting. See *Melting*.
- odour, 48.
- optical properties, 502.
- oxidation, surface, 294.
- photoelectric effect of films on nickel, 661.
- photoelectric emission, effect of adsorbed oxygen, 457.
- photoelectric thresholds in turned state, 93.
- plated tableware, U.S. Federal specification, 737.
- polished surfaces, structure, 590.
- potassium films on, photoelect. properties, 203.
- powders, 544.
- price, factors affecting, book, 547.
- properties, review, 643.
- recrystallization, 457.
- refining. See *Refining*.
- reflectivity, in spectral region 300-186 μ , 564; in ultra-violet, 68, 416.
- residues, elect. recovery, 179.
- rolling. See *Rolling*.
- separation. See *Analysis*.
- sheets, prodn., faults, 631.
- single crystals. See *Single crystals*.
- soldering. See *Soldering*.
- solders. See *Alloys: Solders*.
- solubility in alkaline cyanide solns., 500.

Silver,

- specific heat, at high temps., 457; at low temps., 205.
- spherulitic particles, prodn. by slow crystn., 54, 683.
- statistics, 735; for 1933, 740.
- tarnishing, 102, 739; prevention, 296.
- taste, 48.
- thermal conductivity, effect of cold-work, 277.
- thermal expansion, 43, 367; x-ray detn., 274.
- thermoelectric effect, 453.
- transition of electrons to dielectric, 49.
- transport number in liquid silver amalgam, 581.
- uses, 737; see also entries above.
- valency in liquid silver amalgam, 581.
- vapour pressure, 209, 502.
- viscosity, 498.
- volatilization through chloride, 502.
- wastes, treatment, 72.
- Silver alloys. See *Alloys*.
- Silzin-bronze. See *Alloys*.
- Single crystals,
 - behaviour, calculation of properties of polycryst. metals from, 588.
 - Bitter's patterns, 595.
 - cathode-ray diffraction, 380.
 - compressibility, 666.
 - cutting, effect, 89.
 - deformed, changes in properties by recovery, 208.
 - distortion, book, 87 (review).
 - electrical resistance, magnetic change, 587.
 - electrons diffracted by, depth of penetration, 224.
 - preparation, furnace for, 511-512.
 - properties, review, 47.
 - recrystallization, 587.
 - state, 335, 423.
 - strength, 664.
 - sub-boundaries, 467.
 - thermal resistance at low temps., detn., 198.
 - thermoelectric effects, symmetry, 49.
- Single crystals of—
 - Alloys, solid soln. formation, 512.
 - Aluminium, deformed, recovery during rest, 207; effect of cutting with knife, 89; nature of rest & recrystn., 553; plastic deformation under tension, 553; prodn., modification of Carpenter & Elam's method, 453; recovery & recrystn., x-ray study, 685; shear-hardening & recrystn., 290; softening by relaxation, 413.
 - Antimony, thermal expansion, 333.
 - Antimony-tin alloy, magnetic anisotropy, 581.
 - Bismuth, change of elect. resistance at m.p., 365; changes in thermal & elect. conductivity in magnetic field, 497; 8 principal elect. conductivities in magnetic field, 567; elect. conductivity surfaces, 413; magnetostriction, 89, 413; mech. twinning, 685; plasticity, effect of occluded gas, 655; prepn. *in vacuo*, 655; temp.

Single crystals of—

Bismuth,

function of x-ray reflection near m.p., 100; thermal conductivity, effect of magnetic field, 41; thermal expansion near m.p., 41; thermal resistance at low temps., 198.

Bismuth alloys, magnetostriction, 89.

α -Brass, cold-rolled, orientation changes, 15, 100.

Cadmium-tin alloy, magnetic anisotropy, 581.

Copper, (100) & (111) faces, photoelect. properties, 222; hardness, effect of temp., 619; lineage structure, 156, 685; sub-boundaries, 467; torsion tests, 273.

Ferromagnetic materials, Bitter's patterns, 595.

Gallium, change of resistance in magnetic field, 455, 556.

Gallium-tin alloy, magnetic anisotropy 581.

Gold-silver alloys, elastic properties, 419.

Iron, magnetostriction, 91.

Iron-silicon alloys, discontinuities in magnetization, 91.

Lead, creep, 333, 658; prepn., 333, 658; superconductivity, 659.

Mercury, coeff. of expansion, 558; mech. behaviour, 90.

Nickel, magnetostriction, 91.

Selenium, combined with platinum film, temp. effects on photo-voltaic current & e.m.f., 204; x-ray study, 223.

Silver, electrolytic growth in aqueous solns., 238; prepn., 140, 457.

Thallium, diamagnetism, 457.

Tin, cuttability, 334; elastic properties, 275; magnetic anisotropy, 581; prepn., 424; slip under shear, 425; twinning, 424, 545.

Zinc, (deformed), recrystn., crystn. nuclei, 684; distortion, 379; effect of grain boundary on deformation, 5, 92; effect of temp. gradient on orientation, 223; elastic properties, 275; elastic properties, effect of impurities, 276; elect. resistance, 5, 46, 275; growth, effect of cadmium, 368; recrystn., part played by mech. twinning, 684; space lattice, distortion in mech. twinning, 684.

Sintering,

book, 39.

preparation of alloys by, 148.

Sintering of—

Molybdenum pressed powder, 258.

Powdered metals, 181.

Sinterkorund. See *Refractory materials*.

Slags,

surface tension, 464.

viscosity, book, 321.

Sliding of metals, surface temperature, 563.

Sliding resistance, dynamic, 356.

Slip bands, x-ray study, 289.

Smelting of—

Type metal ashes, 626.

Sodium (see also *Alkali metals*), detection. See *Analysis*.

discharge, potential at mercury cathode, 302.

electrical conductivity, effect of pressure, 143.

electrical resistance, effect of pressure, 274.

electrode potentials in liquid ammonia, 704.

entropy, 564.

estimation. See *Analysis*.

Hall effect, 140.

magnetic susceptibility, 667.

parachor, 564.

solution rate in solns. of methyl- & ethyl alcohol, benzene, toluene, & xylene, 560.

thermal ionization from tungsten & molybdenum, 205.

thermoelectric force, 456.

vapour, spontaneous ionization at incandescent tungsten & rhenium surfaces, 45.

viscosity, 141, 498.

volume changes, effect of pressure, 274.

Sodium alloys. See *Alloys*.

Softening. See under names of metals.

Soils, corrosion by. See *Corrosion*.

Soldering,

advances, 485.

fluxes, 539.

hard, 398; oxy-acetylene, 362.

machines, 539.

pastes, 539.

powders, 635.

soft-, methods, 539.

Soldering of—

Aluminium, 78, 183, 260; cables, 312; castings, 397; foil to brass, 635; pipe, 76; reaction-, 540; reviews, 397, 635.

Aluminium alloys, 260, 539; review, 635.

Beryllium-copper alloys, 673.

Brass, comparison of solders, 727; hard, with silver solder, 540.

Bronze, hard, with silver solder, 540.

Cables, wiped joints, 119.

Copper, pipe, 76; sheets, 184.

Gold, 635.

Lead cable-sheath, elect., 635.

Light metals, 485.

Molybdenum to copper, 76.

Monel metal, 121; silver-, 399, 540.

Neusilber, 635; hard, with silver solder, 540.

Nickel, with silver solder, 399, 540.

Sheet, with silver solder, 540.

Silver, 635.

Tombak, 635.

Solders. See *Alloys*.Solid solutions. See *Alloys*.

Solid state,

book, 324 (*review*).

changes, kinetics, book, 87 (*review*).

Solids, chemistry, book, 323 (*review*).

Sormite. See *Alloys*.

South America, ores, book, 406.

Spain, Physico-Chemical Institute, Madrid, elect. equipment, 265.

- Spark plugs**, improvement, 317.
Spartan. See *Alloys*.
Specific gravity. See under names of metals.
Specific heat (see also under *Alloys* & names of metals),
 anomalous, theory, 666.
 at high temperatures, 275, 415, 457, 561, 617.
 book, 491.
 measurement at higher temps., 617.
 of crystals, theory, 143.
 true, method of detn., 370.
Specifications, acceptance-rejection requirements, 110.
Spectra, indexing, graphical method, 427.
Spectrometers. See *Laboratory apparatus*.
Spelter. See *Zinc*.
Spherulites, metallic, character, 54.
Spinning of—
 Metals, 360
 Pewter, 178.
Sprayed metal coatings (see also *Alloys* & under names of metals),
 adherence, 698.
 applications, 61, 105, 386, 602, 603, 604, 605, 739.
 corrosion-resistance, improvement, 61.
 density, 698.
 expansion coeff., 698.
 hardness, 472, 698.
 improvement, 386, 473.
 porosity, 61.
 properties, 602.
 protective value, 164.
 tests in alkaline liquors, 602.
 wear, 698.
Spraying of—
 Aluminium, appns., 602; cold-, 386; in oil industry, 603, 604, 699; in shipbuilding, 603; in sugar mills, 35; on boiler tubes, 603; on hot oil pumps, 603; on loco. boilers & fireboxes, 603; on steel, 604; on steel for heat-resistance, 698.
 Babbitt metal, 643; on bearings, 603.
 Brass on steel, adhesion of deposit, 604.
 Bronze on bronze, 641.
 Cadmium on aircraft, 604.
 Copper in elect. industry, 739.
 Lead, in soap plant, 604; on railway signals, &c., 603; on submarine battery chambers, 699; review, 164.
Metals, 522; appns., 61, 105, 602, 603, 604, 605, 739; bibliography, 698; book, 652 (*review*); cleaning prior to, 633; design of equipment, 699; filling blow-holes by, 698; in Canada, 349; in elect. industry, 647; in oil refinery, 432, 603, 699; in railway work, 603; in refrigerating industry, 699; in shipbuilding, 603, 699, 700; in soap plant, 604; Mellozing process, 699; methods, 233; on cores & castings, 233; on Diesel marine engine linings, 698; on machine parts, 349; on oil tank floating roofs, 603; patents, 233; pistols, 386; repair of cavitated water turbine, 646; Schliha process, 739; Schoop process, 61, 602;
 Spraying of—
 Metals,
 Schoop process, book, 548; Schoop process, investigation of process, 698; Schori pistol, 602; wire process, 522, 700; wire v. powder method, 602.
 Monel metal, in soap plant, 604; on propellers & shafts, 603.
 Tin, in food industries, 604; in soap plant, 604.
 Zinc, appns., 604; for repairs of zinc coatings, 603; in shipbuilding, 603; in soap plant, 604; on aircraft, 604; on bridges, 605; on iron, tests, 604; on lock gates, 604; on railway rail-ends, &c., 603; on steel, tests, 604; review, 298.
Spring materials, torsional moduli at elevated temps., 10.
Springs, manuf., bibliography, 39.
Sputtered films. See *Films*.
Sputtering,
 by incidence of slow ions, 564.
 data for 12 metals, 48.
 on breaking contact, 210.
 surface motion of particles, 93.
 theory, 48.
Stainless steels. See *Alloys : Steels*.
Stalinit. See *Alloys*.
Stamping,
 book, 190.
 safety devices, book, 740 (*review*).
Stamping of—
 Brasses, caps, 182; hot-, 118.
 Bronzes, hot-, 118.
 Duralumin, experiments, 182.
 Monel metal, 445.
Standardization, book, 83.
Standards,
 A.S.T.M., book, 647; index, 81; (tentative), book, 81.
 German, book, 490.
 samples of National Bureau of Standards, pamphlet, 270.
Statistics, metal, books, 191, 268; see also *Alloys* & under names of metals.
Stearic acid, boiling, resistant material, 17.
Steels. See *Alloys*.
Stellite. See *Alloys*.
Stereotype metal. See *Alloys : Type metals*.
Strain, state of, effect on changes of shape, book, 409.
Strapazoid, 262.
Stray currents,
 corrosion by. See *Corrosion*.
 measurement, ammeter for, 695.
Strength of materials. See *Materials*.
Stress-corrosion. See *Corrosion-fatigue*.
Stresses,
 buckling, 479.
 determination, appn. of x-rays, 225.
 due to impact, photo-elastic study, 392.
 elastic. See *Elastic stresses*.
 in fabricated structures, control, 540.
 in welds. See *Welds*.
 internal. See *Internal stress*.
 measurement by optical double refraction, 246.

- Stresses**,
 prolonged, review of researches, 466.
 working, 438; under impact, 69.
- Strip**, tolerances, 264.
- Strontium** (see also *Alkaline earth metals*),
 detection. See *Analysis*.
 estimation. See *Analysis*.
 melting point, 454.
 statistics, 733.
- Strontium alloys**. See *Alloys*.
- Structure**,
 crystal. See *Crystal structure*.
 fine, study by x-rays, 513.
 mosaic. See *Crystals*.
 rolling. See *Rolling texture*.
 secondary. See *Crystals*.
 segregate. See *Widmanstätten structure*.
- Studite**. See *Alloys*.
- Succinic acid**, corrosion by. See *Corrosion*.
- Sugar factory apparatus**, corrosion. See *Corrosion*.
- Sulphides**. See *Alloys & compounds*.
- Sulphur**,
 corrosion by. See *Corrosion*.
 estimation. See *Analysis*.
- Sulphuric acid** (see also *Acids*),
 corrosion by. See *Corrosion*.
 estimation. See *Analysis*.
 industry, materials for, 80.
- Superconductivity** (see also *Alloys & under names of metals*),
 and diamagnetism, 278.
 and Fermi-Dirac statistics, 211, 669.
 detection at low temp., 568.
 effect of bends, 670.
 effect of crystallite size, 669.
 in rapidly alternating fields, 212.
 magnetic effect at commencement, 211.
 magnetic test, 211, 212.
 of alloys, disturbance by elect. current, 219.
 of films, 277.
 phenomena, 567, 568.
 review, 144, 502.
 rôle of electrons, 669.
 theory, 144, 211, 502, 567, 669.
 thermodynamics, 144, 502.
 transition temperatures, film thickness &, 212.
- Superconductors**,
 effective permeability, 277.
 heat production by a.c., 669.
 magnetic effects, 144.
 magnetic properties, 212, 669.
 ohmic resistance, upper limit, 670.
 penetration of transverse magnetic field into, 277.
 persistent currents, 669.
 phase equilibrium in magnetic field, 567.
 thermoelectric power, upper limit, 670.
- Supercooling**, 207.
- Super-hard alloys**. See *Alloys*.
- Supernickel**. See *Alloys*.
- Surface tension** (see also *Alloys & under names of metals*),
 of molten metals & alloys, 464.
 of slags, 464.
- Surfaces**,
 composite, temp. coeff. of work-function, 370.
 effect of slow electrons, 277.
 electron potential energy at, relation to exit work, 212.
 finishing, 634, 726.
 friction, effect of adsorption, 143.
 light diffusion, appn. to corrosion study, 60.
 migration of adsorbed atoms, 210.
 molecular layers of fatty substances, 468.
 oxide films, structure, 590.
 polished. See *Polished surfaces*.
 preparation for protective coatings, 183.
 roughness, detn., 246, 714.
 smoothness, detn., 110.
 solid, energy exchanges between inert gas atoms &, 93.
 structure, electron diffraction and, 289.
 turned, photoelectric thresholds, 93.
- Surveying plans**, appn. of metal sheets, 188.
- Sweden**, Statens Provvningsanstalt, Stockholm, report, 1933-1934, 86.
- Tailings**, mounting, for micro-examination, 343.
- Tantalum**,
 analysis. See *Analysis*.
 atomic weight, 500.
 capacitors, 643.
 crystals, deformed, change in intensity of x-ray reflection, 425.
 deposition. See *Deposition*.
 electrolytic valve action, 334.
 heat of relaxation from recrystn. data, 563.
 metallographic etching, 220, 682.
 metallography, 220.
 occurrence, 663.
 properties, review, 663.
 separation. See *Analysis*.
 specific heat at high temps., 275.
 statistics, 738.
 superconductivity, 458.
 thermionic constant A , apparent, 662.
 thermionic properties, 274.
 uses, 663.
 welding. See *Welding*.
- Tantalum alloys**. See *Alloys*.
- Tantalum carbides**. See *Alloys & compounds*.
- Tar**, protection of metals with, 234.
- Tarnishing** (see also *Corrosion*, *Alloys*, & under names of metals),
 measurement, 19; reflection meter for, 172.
 of molten metals, x-ray study, 687.
- Tartaric acid**, corrosion by. See *Corrosion*.
- Taste** of metals, 48.
- Technical definitions**, glossary, 39.
- Technology**, V.D.I. year-book, 196 (review).
- Tellurium**,
 allotropy, 141.
 atomic weight, 500.
 detection. See *Analysis*.
 electrical conductivity, effect of addns., 661; effect of impurities, 141.

- Tellurium**,
 electrical resistance, effect of pressure, 274; temp. coeff., effect of impurities, 141.
 estimation. See *Analysis*.
 films, reflectivity, 48.
 occurrence, 663.
 properties, review, 663.
 separation. See *Analysis*.
 statistics, 738, 740.
 thermoelectric power, effect of impurities, 141.
 uses, 79, 663.
 volume changes, effect of pressure, 274.
- Tellurium alloys.** See *Alloys*.
- Temperature**,
 control. See *Laboratory apparatus: Thermostats, &c.*
 high. See *High temperatures*.
 indicators. See *Laboratory apparatus*.
 low. See *Low temperatures*.
 measurement, paints for, 176; see also *Pyrometry*.
 regulators. See *Laboratory apparatus*.
 scales, 621.
- Tempering** (see also *Annealing, Heat-treatment, &c.*)
 of aluminium alloys, mechanism, 337.
- Tenacity**, theory, 47.
- Tensile properties** (see also *Alloys & under names of metals*),
 effect of grain-size, 154.
- Tension-testing.** See *Testing, & Testing machines*.
- Tensometer.** See *Testing machines*.
- Termites**, attack on lead cable-sheath, 200.
- Ternary alloys.** See *Alloys*.
- TESTING, METHODS OF —**
 alternating torsion & bending, book, 134 (*review*).
 at low temperatures, review, 715.
 bend, 533.
 bending-tensile, 174.
 bibliography, 39.
 book, 271 (*review*).
 breaking strength, under dynamic forces, 715.
 brittleness, 422; book, 87 (*review*).
 compression, 438.
 corrosion. See *Corrosion*.
 creep, 142, 247, 392, 714; A.S.T.M. method, 110; bibliography, 714; comparison of single step long-time results with Hatfield's time-yield stress, 28; interpretation of results, 246.
 cupping, fluid-pressure, 630.
 definitions, 173.
 ductility, 438.
 dynamic, 305.
 effect of notches & laws of similitude, 110.
 elasticity, x-ray measurement, 533.
 elongation, of copper & its alloys, 27.
 fatigue, high-speed, at low temps., 355, 714; of cable-sheath, 714; of welds, 69, 364; x-ray diffraction, 248.
 Testing, methods of —
 full-scale, 173.
 hardness, 357, 438, 479, 715; at high temps., 619; Brinell & scratch numbers compared, 247; need for study, 207; of crystals, 111; of light metals & alloys, 356, 715; of surfaces, 619; pendulum, 174.
 high-temperature, 139.
 impact, 438; A.S.T.M. methods, 111; bibliography, 39; comparison of machined & die-cast specimens, 111; notched-bar, 247; notched-bar, book, 87 (*review*); of aluminium alloys, 281; sources of error in pendulum hammers, 618.
 impact torsion, 356.
 internal defects, revealing by ultrasonic vibrations, 479.
 internal strain, by radiograph, 248.
 internal stress, of tubes, 247.
 linear expansion, A.S.T.M. method, 110.
 magnetic, 247; terms, units & symbols, A.S.T.M. definitions, 619.
 non-destructive, 355.
 particle size, 249.
 resilience, 533.
 samples, representative, 713.
 standardization of methods, 173, 354.
 strain measurements, factors affecting, 110.
 surface roughness, 246.
 tensile, 438; A.S.T.M. methods, 110; analysis, 533; cohesion relations of stretched & compressed specimens, 175, 533; of anti-friction alloys at elevated temps., 715; of overhead lines, 247; relation between dynamic & static, 715.
 torsion, 438.
 transverse, 438.
 wear, 55; of Babbitt, 109.
- Testing machines**,
 calibration, 173.
 compression, developments, 28, 111, 439.
 cupping, 715.
 deep-drawing, Wazau, 31.
 exhibition, 174.
 extensometers, comparator, 619; for wires, 391; interference, 138; surface, 247.
 fatigue, 480, 533, 714; electromagnetic, 618; for wire, 714; Haigh-Robertson, 69; high-speed, 110; Pulsator, 533.
 for small diameter wire, 355, 714.
 Griffin-Gale, 715.
 hardness, 392, 439; indentation, 175; pendulum, 69; with diamond indenters, 715.
 impact, 69, 306; Oxford, 28.
 impact torsion, 356.
 micro-, 174; photographically recording, 392, 618.
 new, 246.
 photo-elasticity, 28.
 tensile, development, 28, 111, 439; for fine wires, 174; for small test-pieces, 439.
 Tensometer, 111.

- Testing machines,
 torsion, 533.
 transverse, development, 28, 111, 439.
 verification, A.S.T.M. methods, 111.
 wear, 714.
- Testing of—
 Aircraft materials, 713.
- Antifriction alloys, tension, at high temps., 715.
- Bearing metals, 714.
- Cable-sheaths, fatigue, 714.
- Cables, book, 194 (*review*).
- Castings, 246.
- Copper wire, 725.
- Die-castings, book, 325 (*review*).
- Electrical resistance alloys, A.S.T.M. methods, 619.
- Refractories. See *Refractory materials*.
- Sheet, bibliography, 630; discussion, 630; Erichsen, standard values, 174; fluid-pressure cupping, 630; Rockwell hardness, effect of thickness, 111.
- Welded aluminium tyres, 247.
- Welds, 174, 247, 480; book, 322; fatigue, 69, 364; free-bend, 69; observation, 261; principles, 618; static, 392.
- Wire ropes, book, 194 (*review*).
- Wires, alternate bend strength, 174, 438.
- Thalassal. See *Alloys*.
- Thallium,
 allotropy, 142.
 anodic behaviour in halogen hydrogen acids, 44.
 atomic weight, 500.
 cold-work, effect, method of study, 142; recovery from, review, 142.
 detection. See *Analysis*.
 effect of heat-treatment, method of study, 142.
 electrical resistance at low temps., 554.
 estimation. See *Analysis*.
 occurrence, 663.
 properties, review, 663.
 single crystals. See *Single crystals*.
 specific heat at low temps., 457.
 statistics, 738.
 surface tension, change with time, 461.
 uses, 79, 663.
 vapour pressure, 366, 563; curves at very small vapour densities, 560, 661.
- Thallium alloys. See *Alloys*.
- Thermal conductivity (see also *Alloys* & under names of metals),
 at high temperatures, method of study, 6.
 at low temperatures, 212.
 at very low temperatures, 144, 502.
 determination, methods, 667.
 effect of cold-work, 277.
 effect of pressure, 666.
 measurement, methods, 715; up to 600° C., apparatus, pamphlet, 86.
 of bars, detn., 14.
 of small bars, detn., 357.
 review, 667.
 theory, 144, 502.
- Thermal expansion (see also *Alloys* & under names of metals),
 effect of pressure, 666.
 measurement. See *Laboratory apparatus*.
 x-ray determination, 202, 208.
- Thermal resistance, Norbury relation, 422.
- Thermal treatment. See *Heat-treatment*.
- Thermionic properties (see also under names of metals),
 constants of clean metals, apparent, 662.
 emission, review, 668.
 work-function, detn., 274.
- Thermocouples (see also *Pyrometers*),
 Alumel, 175.
 bibliography, 533.
 Chromel, 175.
 Chromel-Alumel, standard tables, 306, 322.
- Constantan-iron, breakdown when used in zinc-coated iron tube, 393.
- electromotive force, vacuum tube amplifier, 249; variation with magnetization, 566.
- elements, non-metallic, 306.
- errors in temp. measurement, 533.
- for gas temperatures, 176.
- materials for, testing, 306, 321.
- testing, 306, 321.
- Thermodynamic properties. See under names of metals.
- Thermodynamics of stationary systems, 565.
- Thermoelectric effect (see also under names of metals),
 and superconducting state, 417.
 in single crystals, symmetry, 49.
 mean free path of electrons &, 459.
- Thermoelectric e.m.f., due to magnetization, 212.
- Thermoelectric force,
 absolute scale, 460.
 and electrical resistance, 277.
 at low temperatures, 584.
- Thermoelectric properties (see also *Alloys* & under names of metals),
 of ferromagnetic materials, variation with magnetic field & temp., 566.
- Thermoelectromotive force, variation with magnetization, 566.
- Thermomagnetic effects. See under names of metals.
- Thermometers. See *Laboratory apparatus*.
- Thermopiles. See *Laboratory apparatus*.
- Thermostats. See *Laboratory apparatus*.
- Thomas-Fermi method,
 applied to solid metals, 291.
 in metals, 226.
- Thorium,
 estimation. See *Analysis*.
 photoelectric threshold, change when treated with small amts. of O₂, 501.
 production, 204.
 specific heat, 5.
 sputtering from tungsten, 457.
 statistics, 738.
 temperature scales, at 0.667 μ , 621.
 uses, 204.
- Thorium alloys. See *Alloys*.
- Thorium oxide. See *Refractory materials*.

Tin,

- β -, transformation to α -modification, 661, 662.
- allotropy, 500; effect of bismuth, 334.
- analysis. See *Analysis*.
- anodic behaviour in electrolysis of sodium stannate solns., 388.
- black spots, 471, 544.
- blackening of foil. See *Corrosion*.
- buffing. See *Buffing*.
- cementation of metals by, 385, 698.
- cold-work, recovery from, review, 142.
- contamination of foods, 543.
- corrosion. See *Corrosion*.
- crystallization of ingots, 683.
- crystals, elastic properties, 275; twinning, 221, 685.
- deposition. See *Deposition*.
- deposits, as corrosion-resistants, 696; hot-dipped, factors influencing formation & structure, 285, 319, 470; on copper, striations, 520; on iron, porosity, electro-graphic testing, 600.
- detection. See *Analysis*.
- development, 488.
- diffusion of mercury, 282.
- economic control, pamphlet, 320.
- effect of aluminium, 375.
- effect of bismuth, 334, 375.
- effect of manganese, 375.
- electrical resistance at low temps., 554.
- electron diffraction patterns, 224.
- estimation. See *Analysis*.
- films, effect of light on elect. resistance, 48; reflectivity, 48; scattering of light, 336; superconductivity, 277, 662; superconductivity, effect of magnetic fields, 662; transparency in ultra-violet, 276.
- foil, blackening. See *Corrosion*; effect on keeping quality of butter, 542.
- fuse wire, melting time, 644.
- grain-growth, effect of added metals, 12.
- history, 488.
- in brewery, 738.
- in building, 126.
- industry in 1935, 127.
- lacquering. See *Lacquering*.
- magnetic susceptibility, change, 204, 460.
- magnetism, 662.
- molten, oxide films, electron diffraction study, 99; tarnishing, 687.
- oxidation, electron diffraction study, 59; rate, 597.
- oxide films on, structure, 590.
- pest, 415.
- photoelectric thresholds in turned state, 93.
- polished surfaces, structure, 590.
- polymorphism, effect of mech. deformation, 560; review, 92.
- recrystallization, effect of added metals, 12.
- refining. See *Refining*.
- reflectivity, ultra-violet, 416.
- removal of sulphur, 441.
- research, pamphlet, 320.
- separation. See *Analysis*.

Tin,

- single crystals. See *Single crystals*.
 - specific heat, 45.
 - spraying. See *Spraying*.
 - statistics, 737.
 - superconducting, magneto-caloric effect, 662.
 - superconductivity, 458; of films, 662; of films, effect of magnetic fields, 662.
 - superconductors, magnetic behaviour, 500.
 - surface chemistry, 368.
 - tarnishing, 19; atmospheric, 516.
 - tensile properties, effect of added metals, 12.
 - torsion, diagrams, 356.
 - uses, 488, 740; see also entries above.
 - vapour pressure, 209.
 - viscosity, 498.
 - wetting power, 501.
 - white, crystalline structure, 223; transformation to grey tin, 415, 661, 662.
 - wires, thin, prepn. by freezing molten metal, 501.
- Tin alloys.** See *Alloys*.
- Tinned metals,** corrosion. See *Corrosion*.
- Tinning of—**
- Grey cast iron, hot-, 520.
 - Wires, electro-, 301.
- Tinplate,**
- analysis. See *Analysis*.
 - as corrosion-resistant, 696.
 - beer cans, 643.
 - cleaning. See *Cleaning*.
 - corrosion. See *Corrosion*.
 - detinning, 179.
 - improvement by superimposed electro-depn. of tin, 702.
 - industry, British, history, 188.
 - lacquering. See *Lacquering*.
 - manufacture, 431, 472.
 - polishing. See *Polishing*.
 - porosity of coatings, detn., 431.
 - pressing. See *Pressing*.
 - research, review, 430.
 - scrap, recovery, 536.
 - sealed containers, evolution, 188.
 - testing for food preservation, 21.
 - testing of coating, 709; optical, 431, 520, 696; rapid, 431.
 - tin-plating. See *Deposition*.
 - uses, 188, 403.
 - variation of substance, 696.
 - yellow stains, 430, 431.
- Titanium,**
- diffusion into iron, 466.
 - estimation. See *Analysis*.
 - in light alloys, 126, 542.
 - in steels, 126, 542.
 - statistics, 738, 740.
- Titanium alloys.** See *Alloys*.
- Titanium carbide.** See *Alloys & compounds*.
- Tomato products,** corrosion by. See *Corrosion*.
- Tombak.** See *Alloys*.
- Torsion testing.** See *Testing, & Testing machines*.
- Torsional strength.** See *Alloys & under names of metals*.

- Toxicity.** See under names of metals.
- Transformations,**
from solid to liquid, 370.
heat changes associated with, 414.
polymorphic, 415.
x-ray studies, 101.
- Transverse testing.** See *Testing*.
- Triboelectric effect.** See under names of metals.
- Tube drawing,**
flow of metal, 257, 309.
stresses, 257, 309.
Wellman process, 724.
- Tube-drawing of—**
Brasses, book, 411 (*review*).
- Tubes,**
collapsible, finishing, 726.
condenser. See *Condenser tubes*.
corrosion. See *Corrosion*.
galvanizing. See *Galvanizing*.
joints, types, 37.
protection against corrosion, 518.
seamless, manuf., 74, 360, 483.
welding. See *Welding*.
- Tungsten,**
action of nitrogen, 209.
adsorbed atoms on, migration on surface, 210.
adsorption of composite films of oxygen & hydrogen, 560.
adsorption of hydrogen, 560, 665; heat, 92.
adsorption of oxygen, 560.
anodic behaviour in aqueous potassium hydroxide solns., 169, 435.
bibliography, 737.
catalysis of ammonia on, effect of thorium, 663.
contact p.d. between barium &, 368; between clean & oxygenated, 500.
crystal structure of heat-treated filaments, 468.
crystals, deformed, change in intensity of x-ray reflection, 425.
deposition. See *Deposition*.
ductile, development of working, 116; manuf., 188.
electrical resistance as function of temp., 368.
electrolytic valve action, 334.
electron emission, 681.
emission characteristics of filaments, 334.
emissive power in ultra-violet at high temps., 561.
estimation. See *Analysis*.
filaments, ideal, characteristic equations, 404; in gas-filled lamps, 264; prodn. from powdered metals, 544.
films, elect. conductivity in electrostatic field, 210; sputtered, threshold value, 564.
Forsythe-Watson temperature scale, appn., 45.
gas evolution on heating in vacuum, 92.
heat-losses of wire in helium, 204.
heat of relaxation from recrystn. data, 563.
hot surfaces, alkali metals adsorbed on, rate of evapn., 93.
- Tungsten,**
hydrogen overvoltage in aqueous potassium hydroxide solns., 169, 435.
in electrical industry, 633.
incandescent surfaces, spontaneous ionization of sodium & cesium at, 45.
internal potential, 662.
ionization of alkali metal atoms on, 205.
metallographic etching, 682.
occurrence, 188.
powder, manuf., 188.
production, electro-, from fused phosphate bath, 239.
radiation as function of temp., 368.
refraction of slow electrons, 662.
separation. See *Analysis*.
sheet, manuf., 633.
statistics, 188, 737.
sublimed, refraction of slow electrons, 662.
thermal expansion, x-ray detn., 208.
thermionic constant A , apparent, 662.
thermionic electron emission, 45.
thermionic emission with weak accelerating fields, 458.
thoriated, contact potential, 205; diffusion coeff. of thorium, 205; electron emission, 370; ionization of alkali metal atoms on, 205; photoelectric emission, 45; rate of decomn. of ammonia, 663; thermionic consts., dependence on applied field, 459.
uses, 188.
wire, manuf., 633.
- Tungsten alloys.** See *Alloys*.
- Tungsten carbide.** See *Alloys & compounds*.
- Tungum.** See *Alloys*.
- Turbines,** repair by metal spraying, 646.
- Turned pieces,** roughness, factors affecting, 182.
- Turning,** tools, life, 32.
- Turning of—**
Aluminium, 75, 446; lubricants, 32.
Aluminium alloys, 75, 446.
Monel metal, 633.
- Twinning.** See *Crystals*.
- Type metals.** See *Alloys*.
- Ultra Fuson,** 234.
- Ultra-violet light,** reflection, 416.
- Union of Soviet Socialist Republics,**
beryllium industry, 80.
cobalt industry, 739.
rare alkali metal industry, 739.
refractories industry, 116.
- United States of America,**
American Society for Testing Materials, year-book, 544.
chemical patents index, 40.
chemistry in, book, 654 (*review*).
Engineering Foundation (U.S.A.), report, 320.
Government Printing Office, report, 131.
National Research Council Division of Chemistry & Chemical Technology, report, 491.
Navy Department, specifications for inspection of material, 618.

United States of America.

Pacific N.W., appn. of cheap hydroelectric power to metal & mineral prodn., pamphlet, 129.

rare metals industry, 740.

Smithsonian Institution, report, 492.

Stanford University, theses, 270.

Universities, theses, 266, 407.

University of Pittsburgh, theses, 549.

Washington and Pacific N.W., economic possibilities for electrometallurgical industries, pamphlet, 129.

Uranium,

bibliography, 737.

embrittlement, 459, 663.

estimation. See *Analysis*.

photoelectric threshold, change when treated with small amts. of O₂, 501.

production, 204.

statistics, 737, 738.

uses, 204, 737.

Vacuum, melting in. See *Melting*.

Vacuum vessels, current leads, 264.

Valves,

all-metal, 646.

materials, 126.

seats, wear, 126.

Vanadium,

bibliographies, 543, 737.

detection. See *Analysis*.

effect on metals, theories, 205.

estimation. See *Analysis*.

history, 543.

industry, 127.

manufacture, 543.

pure, powdered, prodn., 663; prepn., 275.

specific heat at high temps., 275.

statistics, 127, 737.

superconductivity, 275.

uses, 543, 737.

Vanadium alloys. See *Alloys*.

Vaporization of metals (see also under names of metals),

book, 489.

Vapour pressure (see also *Alloys* & under names of metals),

of high-boiling point metals, 209, 502.

-temperature diagrams, 461.

Varnish acids, corrosion by. See *Corrosion*.

Varnishes,

anti-corrosive, 386.

standards, A.S.T.M., book, 647.

Vedal,

properties, 231.

uses, 231.

Viscosity (see also under names of metals),

effect of pressure, 666.

of liquid metals, measurement, 47.

of solid metals, 356.

solid, 336.

Vokar. See *Alloys*.

Volatilization (see also *Alloys* & under names of metals),

of metals through their chlorides, 502.

Volta effect,

effect of temperature, 212.

relation to Peltier effect, 564.

Volume changes, 666; see also *Thermal expansion*, *Alloys*, & under names of metals.

Volume deformation, hyperbolic paraboid, 562.

Wallpaper, metallic, 265.

Washing agents, corrosion by. See *Corrosion*.

Water-gas, carburetted, combustion, 483.

Waters, corrosion by. See *Corrosion*.

Wear (see also *Alloys* and under names of metals).

"initial," in bearings, 55.

reduction by compound contact pieces, 404.

testing. See *Testing*, & *Testing machines*.

Webbite. See *Alloys*.

Weber alloy. See *Alloys*.

Wehnelt effect, 608.

Welding,

acetylene, explosion tests, 364.

acetylene apparatus, high-pressure, safety valves, 123; hydraulic back-pressure valves, inflammable liquids in, 486; rapid detn. of acetylene in generator water, 123.

acetylene cylinders, gas absorption, 401.

acetylene generators, lifting out floating gas-bells, 185.

atomic arc, 260.

atomic hydrogen, developments, 77.

blowpipes, design, 400; designs, 123; French, 123.

books, 547, 549.

bronze-, 313; book, 134 (review); new metals for, 400, 729.

built-up, 264.

butt-, 313; large automatic machine, 122; measurement of contraction, 637; theory, 314.

calcium carbide drums, prevention of accidents in opening, 78.

carbon-arc, Fuller Carbo-Flux method, 313.

codes, pamphlet, 130.

congress, 448.

electric, a.c. versus d.c., 122; book, 327 (review); contraction of seams, 731; generators, development, 78; high-voltage condenser, 637; in railway work, 364; valve control, 636, 637.

electric arc, a.c. & d.c., comparative study, 485, 638; a.c. equipment, 730; automatic, 76; book, 496 (review); energy conversion, 730; d.c., electronic voltmeter, 638; in argon, 400; in chemical industry, 448; in France, 638; phenomena, atomic-physical bases, 77; plant, 485, 638; reviews, 260, 637; temperatures, 620; thermal study, 77; transfer of material, 730; v. gas, 730; with metallic electrodes, book, 650.

electric resistance, 313; appns., 448; control, review, 637; developments, 33; high-speed, Thyatron tube control, 78; "ignitron" timing,

- Welding,**
 electric resistance,
 637; in aircraft construction, 122;
 in France, 637, 730; of thin sections,
 185; seam, 636; theory, 636, 730.
 electrodes, Monel metal, 638.
 flash-, 313.
 fusion, thermal state during, 260.
 gas-, calculation of flame temperatures,
 400; regulators, 400.
 history, 729.
 hygiene, 401.
 in aircraft construction, 729.
 in automotive industry, 313.
 in chemical industry, 260, 261.
 in electrotechnology, 397.
 in vehicles, 364.
 low-temperature, 122.
 metallic arc, 33; book, 194 (*review*);
 report, 130.
 operators, qualification, 77.
 oxy-acetylene, 486, 636; appns. 729;
 book, 649; booklet, 130; equipment
 & gases, precautions in handling,
 541; exit velocity of burning gas
 mixture, 729; French specifications
 for welding rods, 637, 729; history in
 U.S.A., 448; methods, 313; plant,
 122; recommendations, 185; safety
 precautions, pamphlet, 38; thermal
 study, 77.
 reference book, 327 (*review*).
 research in U.S.A., 729; problems, 638.
 rods, copper-copper phosphide, 635;
 Cuprotectic, 635; for oxy-acetylene
 practice, French specifications, 636,
 729.
 safety, 401.
 seam-, 313.
 specifications, pamphlet, 130.
 spot-, 77, 313, 636; and projection-
 welding compared, 122; burning,
 400; elect., thermal, & mech.
 occurrences during, 185; electrodes
 636; electrodes, adhesion of, 400;
 electrodes, design, 485, 636; funda-
 mentals, 362; improvement, 729;
 of 250 pairs of metals, 314; size &
 spacing, 77.
 symposium, report, 649, 742 (*review*).
Welding machines,
 automatic arc, 400.
 electric resistance, automatic, 730.
 electric seam, 730.
 exhibition, 261.
 spot-, capacity, 400.
Welding of—
 Altmag, 121.
 Aluminium, 178; cables, 312; castings,
 362; elect., 313; elect., Russian
 machine, 727; elect. arc, 76; for
 transport & storage of nitric acid,
 33; fusion, 120, 447, 485; gas-
 260; methods, comparative tests,
 362, 727; oxy-acetylene, 398; oxy-
 acetylene, recommendations, 185;
 pastes, 398; pipe, 76; reviews, 397,
 635; sheet, gas-, 120; sheet, ham-
 mer-, 120; special problems, 313;
 tanks, gas-, 313, 727; vessels, gas-, 727.
 Welding of—
 Aluminium alloys, 1, 539; boats, 76;
 castings, review, 638; crank-cases,
 oxy-acetylene, 76, 362; develop-
 ments, 728; fusion, 120, 485; gas-
 260; pastes, 398; railway wagons,
 447; review, 635; spot-, 362, 363,
 635; spot-, Sciaky system, 121.
 Aluminium-magnesium alloys, 121.
 B.B. alloy, 728.
 Beryllium-copper alloys, 673.
 Brass, oxy-acetylene, recommendations,
 185; seam, 635; spot, 635.
 Bronze, overlays on to steel, electric
 arc, 485; oxy-acetylene, recommen-
 dations, 185; propellers, elect. arc,
 121; seam, 635; spot, 635; to steel,
 540.
 Contact points, spot, 636.
 Copper, arc, 33; atomic hydrogen, 76;
 autogenous, 76, 184; bronze-, 363,
 635; difficulties, 729; elect. arc,
 76, 121; elect. resistance, 76; fusion,
 33; high voltage carbon arc, 260;
 loco. fireboxes, 635, 728; oxy-acety-
 lene, 184, 728; oxy-acetylene, effect of
 cuprous oxide, 728; oxy-acetylene,
 recommendations, 185; pipe, 76, 363,
 728; service pipe fittings, 185;
 service pipes, oxy-acetylene, 185;
 sheet, 734; sheets & plates, 76;
 spot-, elect., thermal & mech. occur-
 rences during, 185; tubes, 76.
 Copper alloys, high-voltage carbon arc,
 260; review, 638.
 Duralumin, sheet, elect. resistance, 120;
 spot-, Sciaky system, 121.
 Elkonayt insertions in automobile con-
 struction, 729.
 Galvanized iron & steel, 636.
 Iron, symposium, report, 742 (*review*).
 Lead, 363; cable-sheaths, oxy-acetylene,
 313; oxy-acetylene, 121, 363.
 Light metals, 485.
 Magnalium, 121.
 Magnesium, elect., 313.
 Magnesium alloys, 485.
 Monel metal, 399; autogenous, 540;
 elect., 121; elect. arc, 399; gas-
 399; oxy-acetylene, 121; oxy-acety-
 lene, recommendations, 185.
 Nickel, 399; autogenous, 540; elect.
 arc, 399; gas-, 399; oxy-acetylene,
 635; oxy-acetylene, recommendations,
 185.
 Nickel alloys, autogenous, 540.
 Non-ferrous metals & alloys, 122.
 Pobedit to drills, 363.
 Pressure vessels, 260, 261; a.c. versus
 d.c., 122.
 Stribolts in copper fireboxes, 363.
 Steel, book, 265; symposium, report, 742
 (*review*).
 Structures in chem. industry, 260.
 Super-hard alloys, 635; to drills, 363, 364.
 Supernickel, 399.
 Tantalum sheets, elect. arc, 121.
 Tubes, hammer-, book, 327 (*review*).
 Vokar to drills, 363, 364.
 Wires by condenser discharge, 448.

Welding of—

Zinc, pressure castings, oxy-acetylene, 729; sheets, 447, 636.

Zinc alloy, die-castings, 636; die-castings, oxy-acetylene, 364.

Welds,

butt-, stresses, 731.

chemical and metallographic study, 638.

corrosion. See *Corrosion*.

corrosion-resistance, effect of methods & after-treatment, 77, 314.

fatigue, 638.

fillet, stresses, 731.

impact-strength, 77.

internal stresses, 448.

overstressing, 399, 731.

properties at low temps., 665.

radiology. See *Radiology*.

strength on repeated loading, book, 549.

stresses, 122, 314, 364; analysis, 731;

contraction, 731; math. analysis,

638; measurements on circular seams,

77; residual, measurement, 122.

testing. See *Testing*.

Wettability (see also under names of metals),

of high-m.p. metals, 501.

White gold. See *Alloys*.

White metals. See *Alloys*.

Widia. See *Alloys*.

Widmanstätten structure,

explanation, 219.

in copper-silver alloys, 156, 683.

Wiggin, Henry, & Co., Ltd., history of firm, 488.

Wines, action on metals. See *Corrosion*.

Wire (see also *Filaments*),

brushes, uses in metal cleaning, 633.

cloth, for test sieves, German specification, 739; manuf., 310.

corrosion. See *Corrosion*.

crystal orientation, effect of method of working, 16, 513; photometric measurement, 513.

fabrics, uses, 645.

fine, gauge, 617.

galvanizing. See *Galvanizing*.

history, 310.

netting, history of manuf., 258.

oxidation, kinetics, 597.

plating. See *Deposition*.

ready-to-solder, 727.

resistance-, improvement of efficiency, 298.

rolling. See *Rolling*.

testing. See *Testing*.

thin, prepn. by freezing molten metal, 501.

tinning. See *Tinning*.

trolley, 187.

very thin, detn. of diameter, 143.

welding. See *Welding*.

Wire-drawing,

ancient, 657.

back-pull, 725.

"cupping," 633.

dies, composition, 310; detn. of shape of orifices, 632; diamond, 632, 725; diamond, manuf., 310; effect of form on life & efficiency, 633; hard metal v. iron, 632; steel, setting, 258.

Wire-drawing,

distortion, 309.

drawing angle, 633.

history, 310, 360.

industry, order book of New Wire Co., Cheadle (1788-1831), 452.

lubrication, appn. of metallic coatings, 257; effect of phys. properties of lubricant, 310.

passes, selection, 724.

review, 632.

rupture of wire, 633.

with diamond dies, 181.

Wire-drawing of—

Aluminium, 632; lubricants, 32.

Brasses, phenomena, 117.

Chromium-nickel alloy, elect. heating elements, 509.

Copper, 657, 725; back pull, 725; cold-, relation between reduction of area & breaking stress, 632; distortion characteristics, 309; plant, 181.

Lead-coated steel, lubrication, 257.

Nichrome, 446, 725.

Woods, corrosion by. See *Corrosion*.

Work-hardening. See *Hardening*.

Working of metals (see also under names of processes),

books, 82, 269, 321, 492, 741 (review).

history, 740.

hot-, book, 547.

researches, German, 484.

safety precautions, book, 546.

sheets & tubes, book, 134 (review).

X-ray analysis. See *Crystal structure*.

X-ray equipment. See *Laboratory apparatus*.

X-ray spectra, obtained by rotating crystal method, relation of stereographic crystal projection, 57.

X-rays (see also *Radiology*),

applications, book, 653 (review).

diffraction patterns, use in identification of crystals, 426.

reflection from powders, detn. of intensity, 27.

"Y" alloy. See *Alloys*.

Yachts, materials for, 739.

Yeast,

action of aluminium, 314.

action of copper, 316, 640.

Yield-point. See *Tensile properties, &c.*

Yield-strength. See *Alloys & under names of metals*.

Young's modulus. See *Elasticity*.

Yttrium,

detection. See *Analysis*.

pure, prepn., 141.

Yttrium alloys. See *Alloys*.

Zinc,

action of acids, effect of pressure, 663.

action of nitrogen, 209.

analysis. See *Analysis*.

Zinc.

- anodes, rate of soln. in acid solns., 162, 429.
- cast, structure, effect of cadmium & of rapid cooling, 416.
- casting. See *Casting*.
- chromium-plating. See *Deposition*.
- coatings. See *Galvanized iron & steel*.
- cold-work, effect, method of study, 142; recovery from, review, 142.
- colouring. See *Colouring*.
- contamination of foods, 543.
- corrosion. See *Corrosion*.
- crystals, elastic properties, 275; twinning, 221.
- deformation of single crystals, effect of grain boundary, 5, 92.
- density, effect of small amts. of copper, 141.
- deposition. See *Deposition*, *Galvanizing*, *Sherardizing*, &c.
- deposits, on iron, porosity, electrographic testing, 600; structure, relation to chem. & phys. properties, 469, 683.
- detection. See *Analysis*.
- die-castings, finishing, 119, 634.
- diffusion, into brass, 209; into copper & its alloys, 90.
- effect of heat-treatment, method of study, 142.
- effect of ozone, 19.
- electrical resistance, of single and optically mosaic crystals, 46; of single crystals, 5, 275.
- electrode potentials in liquid ammonia, 704.
- electrolytic, mech. properties, 415; Russian plant at Ordjonikidze, 543.
- entropy, 564.
- estimation. See *Analysis*.
- films, electron diffraction patterns, 225.
- for battery plates, manuf., 92.
- in alloys, replaceability by magnesium, 98.
- in brewery, 738.
- in foundry practice, 394.
- industry in 1935, 127.
- melting. See *Melting*.
- metallurgy, 36; advances, 80, 738.
- molten, oxide films, electron diffraction study, 99; soly. of steels, 92.
- mosaic crystals, elastic properties, 275; elect. resistance, 275; prepn., 275.
- mosaic structure, 46.
- nickel-plating. See *Deposition*.
- painting. See *Painting*.
- parachor, 564.
- photoelectric thresholds in turned state, 93.
- polished surfaces, structure, 590.
- powder, in indust. plant, booklet, 548; in paint, pamphlet, 321.

Zinc.

- printing plates, investigation, 738.
- recrystallization, of single crystals (deformed), crystn. nuclei, 684; of single crystals, part played by mech. twinning, 684.
- refining. See *Refining*.
- reflection coefficient, in spectral region 300-186 μ , 564.
- researches, report of cttee. of Deut. Ges. Metallkunde, 459.
- rolled, finishing, 607; finishing, booklet, 547.
- rolling. See *Rolling*.
- roofing, history to 1835, 644.
- Russian, quality, 488.
- scrap, treatment, 442.
- separation. See *Analysis*.
- service pipes, suitability, 518.
- sheet, uses, 483.
- single crystals. See *Single crystals*.
- specific, heat, at higher temps., 561; at low temps., 205.
- spectra, ultra-violet, 459.
- sprayed coatings, action of reagents, 605; tests, 604.
- spraying. See *Spraying*.
- statistics, 738.
- superconductivity, 459, 663.
- surface treatment, electrolytic, 232.
- thermal expansion (cast & rolled), 561.
- torsion, diagrams, 356.
- uses, 36, 543 (see also entries above).
- vaporization, book, 489.
- vapour pressure, 209, 366, 502, 563.
- viscosity, 498.
- welding. See *Welding*.
- wire fabrics, uses, 645.
- wires, thin, prepn. by freezing molten metal, 501.
- Zinc alloys. See *Alloys*.
- Zinc chloride solutions, corrosion by. See *Corrosion*.
- Zirconia. See *Refractory materials*.
- Zirconium,
 - body-centred cubic, transformation to hexagonal modification, 16.
 - calorimetric behaviour, 415.
 - detection. See *Analysis*.
 - drawing texture, 459.
 - estimation. See *Analysis*.
 - review, 416.
 - rolling texture, 459.
 - sources, 126.
 - statistics, 126, 738, 740.
 - superconductivity, 211; transition temp., 568.
 - thermal expansion, x-ray detn., 202.
 - uses, 126, 404.
- Zirconium alloys. See *Alloys*.
- Zirconium carbide. See *Alloys & compounds*.



PRINTED IN GREAT BRITAIN BY
RICHARD CLAY & SONS, LIMITED,
BUNGAY, SUFFOLK.