



Blasting problems, anthracite mines solution.	222
Blending experiments, Bureau of Mines-American Gas Association carbonization report.	303
Blending properties, high-volatile coals, by American Gas Association carbonization report.	304
Boilers, small, effect of soot on heat transmission.	356
Boiler feed water, conditioning, questions and answers.	346
Boiler plants, operation, smokeloss, importance.	372
Breakers, anthracite prepared at, by members of Andhra Institute, quality.	30
Briquetting, brown coal, Australia.	280
Brown coal, briquetting, Australia.	280
Buckham mines, Virginia, coal, carbonizing properties and petrography.	296
Bureau of Mines, coal-hydrogenation plant, coal investigations, bibliography.	324, 327
Director, annual reports.	3-17, 19, 20
Experimental mine, coal, carbonizing properties.	3-7
Gas analysis, annual reports.	200
Explosives Division, annual reports.	180
Field station, Colorado, work.	3-7, 223-225
Ignition apparatus, gas analysis with.	26
Ignition of fireclamp by explosives research.	43
Midget impinger, for dust sampling, description.	98
Mining Division, annual reports.	86, 90, 93, 95
Nomenclature, annual reports.	3-8, 14-16
Ore apparatus, for analyzing gas faces.	3-7, 9, 10, 17
Permissible apparatus. See Permissible apparatus.	41
Bureau of Mines-American Gas Association carbonization report, blending experiments.	303
Burning characteristics, anthracite coals, relation to properties.	303
Butacene, limiting high-temperature rotational partition function.	116
Butane, limiting high-temperature rotational partition function.	115
vibration, notes.	111
Buene-buene-hydrogen equilibrium constants, relative values.	114
Butene derivatives limiting high-temperature rotational partition function.	116
Buttons, reflector, use, in coal mines.	158
Canada, United States coal market in.	386
Cap lamps, electric, in Alabama coal mines.	252
Carbon dioxide absorption by amines.	111
Carbon dioxide, absorption by amines, extraction of prepurified flames with liquid, for extinguishing coal-mine fire, in Germany.	320
thermoanalytic functions.	211
Carbon dioxide-oxygen relations, discussion.	108
Carbon monoxide, detection, methods, determination.	333
in underground atmospheres, presence, illustration, effect on oxidation of anthracite.	30
oxidation, by bacteria.	94
Carbon monoxide and oxygen, at and above explosion limit, dry and water-catalyzed reaction, fire extinguished with, gases in, phosgene in, determination.	286
Carbonization, coal, effect of oxidation at storage temperatures, subbituminous, Colorado, puritan mines, high-temperature, effect on blending properties of high-volatile coals.	269
Carbonization assays, coal, Colorado, Denver region.	304
Carbonization products, coal, West Virginia.	68
Beckley bed, effect of blending with high-volatile coals.	291
Beckley bed, effect of blending with high-volatile coals.	293

Coal, carbonizing properties, Pennsylvania, Lower Kittanning bed.	294
Upper Kittanning bed.	290, 293
Virginia, Chickwood bed.	291
Upper Banner bed.	291
West Virginia, Atha bed.	289
Beckley bed.	289
Colorado, Grove bed.	289
Denver region.	289
Earle bed.	289
Peachontas bed.	289
Powellton A bed.	289
Sewell bed.	289
characteristics.	289
chemical treatment.	343, 344
classification.	70
committee on, report.	57, 59
curves.	57, 58
standardization.	31, 53
composition, microscopic, relation to coking properties.	56
dewatering.	60
drying.	275
falls, in man-trips, bituminous-coal mines.	275
fineness, effect on inflammability of coal dusts.	167
float-and-sink data, washability curves, explanation, Alabama.	97
Colorado, Denver region.	274
for firing ceramic products, selection.	67
grindability, determination.	353
determining methods, investigation.	68
high-volatile blending properties, by high-temperature carbonization.	35
hydrocarbonated, insoluble residues, sulfur content.	304
hydrogenation.	306
alkalal constituents.	312
banded constituents.	315, 316
chemistry.	318, 310
liquidation by.	323
Pennsylvania, Pittsburgh bed.	323
tars and pitches from, solubility.	321
United States (investigations).	311
ignition, by mine electric circuits.	308
liquidation, by hydrocarbonation.	297
of oxygen-nitrogen-sulfur mixtures.	313
lamp, specific gravity.	315
mine supply, reduction.	77
nature.	401
occurrence.	61
on.	24
oxidation, at moderate temperatures.	336
at storage temperatures, effect on carbonization.	284
petrography, Indiana, Indiana No. 4 bed.	285
Montucky, High Split bed.	295
Millers Creek bed.	291
Pennsylvania, Lower Kittanning bed.	297
Upper Kittanning bed.	290, 293
Virginia, Chickwood bed.	291
West Virginia, Sewell bed.	289
plasticity, characteristics.	292
data.	70
measurement.	34
relation to quality of coke.	73
preparation, Alabama.	34
recent developments, review.	278
properties, relation to burning characteristics.	302
reactivity.	301
research, advances.	344
Bureau of Mines.	18, 22, 23
resources, conservation.	8-17, 20
sampled, methods.	71, 72, 70
sampling methods.	71, 72, 70
size composition, interpretation.	270
stacking, characteristics, Denver region, Colorado.	68
specific gravity.	70
split, origin, Oregon, Coos Bay.	69
stoker tests, Oregon, Coos Bay.	302
Coal, subbituminous, Colorado, Denver region, characteristics.	300
low-temperature distillation tests.	305
Puritan mine, carbonizing properties.	290
swelling.	76
swelling properties, during coking, determination.	62, 63
technology, work, Bureau of Mines, technological branch.	3-17, 20
terminology, advances.	18, 22, 23
testing, standardization.	55
thin sections, preparation.	24, 59
treated by chemicals, burning.	54
typical, classification chart.	338
utilization.	51, 52
recent developments, review.	24, 60
volatile matter, relation to hydrogen: carbon ratio.	2
washability, Alabama, America bed.	75
Black Creek bed.	269
Henry Ellen bed.	271
Tratt bed.	268
Woodstock bed.	269
washability curves, explanation.	268
Coal byproducts, properties, relation of microscopic composition.	277
Coal-cutting equipment, permissible, description.	60
Coal-cutting machines, bits, grinding.	236
Coal drilling, hand-held, permissible, electric, description.	262
Coal dusts, explosibility, international test methods, proposal.	249
tests, large-scale.	406
notes.	38
inflammability, effect of fineness of coal.	105
Coal-dust explosions, mine, rock-dusting to prevent.	106
Coal-hydrogenation plant, Bureau of Mines, description.	212
Coal industry, production control, Great Britain, effects.	324, 327
reduced output, United States, discussion.	309
technology.	387
Coal land, stripped, reclamation.	402
Coal market, United States, in Canada.	150
Coal mines, accidents, electrical.	385
reduction.	200
experience and cost, Colorado.	256
United States.	157
explosives, Utah.	374
blowdowns, dust in, alloying with water.	229
falls, on man-trips.	196, 196
measurement.	167
review.	394
mine-supply coals.	394
multiple-shift mechanical mining.	403
output per man.	171, 172
underground, power drilling, review.	399
Utah.	389
blasting practices, safe, as result of research.	233
cleaning, mechanical, reviews.	229
distributing equipment, sales.	301, 303
dist. explosion systems, voltage, adequate.	395
electric cap lamps, Alabama.	241
employment, data.	212
equipment, permissible list.	252
Experiment, Bureau of Mines, work, review.	258, 259
explosions, annual reviews.	189
fires after, sealing and unsealing.	202-207
Ohio.	104
permissible, characteristics and use.	210
fans, observations, deterioration.	235
performance, experiments.	100
fan installations, main, Mine Safety Board decision.	184
facilities, Alabama.	154
fires, annual reviews.	165
electrical, cause.	202-207
sealing and unsealing.	200
fans, analyzing, with Bureau of Mines Hall data apparatus.	104
with Bureau of Mines Orsat apparatus.	43

Coal mines, gas, detection, methods, electrical ignition, demonstrating, Bureau of Mines apparatus.....	375
Information.....	62-63
Protection against.....	284
Sampling.....	60
Gas fire, Germany, extinguishing, with liquid carbon dioxide.....	157
173, 174.....	68
Handling, safety.....	300
High-tension power circuits, installation, installing ropes, inspection and maintenance, internal-combustion engines, State regulations.....	305
164.....	20
Lamps, permissible electric, description, tests.....	209
166.....	270
Lighting practices.....	257
Loaming, mechanical, review.....	301, 303
Loading equipment, mechanical, sales, States.....	383-386
387.....	122
Long-wall mining methods, Middle Western States.....	340
168.....	730
Machinery, tramming, reducing "nippling" hazards.....	359
255.....	130
Mechanization, Illinois.....	112
166.....	246
Increase, as shown by tonnage mined, progress.....	351
388.....	27, 388
Officials, instruments, familiarity and use, responsibility, in mechanized mining, pillars, rapid extraction, effects, reflector buttons, use.....	362
176.....	309
178.....	325
183.....	403
187.....	149
Roof movement, study.....	182
148, 149.....	74
Safety legislation, milestones.....	68
163.....	300
Safety survey, electrical viewpoint.....	305
253.....	261
Shaft-bottom lay-outs, description.....	222
132.....	118
Slope-bottom lay-outs, description.....	275
152.....	320
Subsidence, physics.....	101
173, 174.....	74
Auxiliary.....	106
168.....	305
Observations.....	241
162.....	248
Relation to health and safety.....	350, 370
167.....	183
Ventilation doors, Mine Safety Board decision.....	163
183.....	289
Coal mining, bituminous, employment, chances.....	249
300.....	260
400.....	378
European, investigation.....	378
ground movement.....	388
144.....	405
Health and safety, promoting, by watering methods, Virginia, Grundy coal field, output per man.....	404
161.....	332
189.....	384
Safety, trends.....	272
175.....	335
182.....	320
182.....	302
145.....	101
Coal placers, southern Appalachian, discussion.....	74
400.....	106
Coal resources, conservation.....	305
27, 388.....	241
Coal ten, composition.....	248
78.....	350, 370
Coal trade, international, competitive conditions.....	183
335.....	289
Coal-washing, Bannan type, performance, pulsator type, performance.....	249
272.....	378
Coal-ore catalyst, preparation for water-gas shift reaction.....	333
326.....	
Coke, American Society for Testing Materials committee, report.....	
32.....	
378.....	
As domestic fuel, information, by hypodermic distribution.....	
388.....	
405.....	
406.....	
404.....	
332.....	
Low-temperature, shrinkage, on heating to higher temperature.....	
331.....	
Quality, relation to plasticity of coal, testing.....	
73.....	
74.....	
328.....	
328.....	
343.....	
Treatment, chemical.....	
343.....	
343.....	
74.....	
74.....	
378.....	
378.....	
Coke-carbon dioxide relations, discussion.....	

## INDEX OF SUBJECTS

Drilling machines, permissible electric, description.....	250	Explosives Division, annual reports, blasting devices, permissibility tests, application.....	3-7, 223-225
Dry coils, in mining, application.....	242	Explosives, permissibility tests, application.....	217
Dusting, coal, explosibility, large-scale tests, in bituminous-coal mines, alloying with water.....	69	Extraction methods, for determining tar acids and bases.....	36, 38
195, 196, 201.....	195, 196, 201	Sulfuric acid, for determining olefins and aromatics in hydrocarbon oils.....	37
In mining, hazards, control.....	80, 90, 93, 91	Falls, on man-trips, in bituminous-coal mines.....	167
with impinger, description.....	80, 90, 93, 91	Fans, centrifugal, performance, charts, coal mine, observations.....	186
Dust particles, atmospheric, petrographic identification.....	275	Fan installations, main, in coal mines, Mine Safety Board decision.....	184
Dust-prevention treatment, solid fuels.....	289	Fatalities, coal mine, Alabama.....	154
Eagle bed, West Virginia, coal, carbonizing properties.....	246	Federal Heating Plant, Washington, D. C., equipment and operation.....	374
Electric air compressors, permissible, description.....	252	smoke and fly-ash prevention.....	350
Electric cap lamps, coal mines, Alabama.....	237	Feed water, boiler, conditioning, questions and answers.....	369, 370
Electric circuits, mine, ignition of coal, hazardous.....	242	Fires, anthracite, mines, significance of oxidation on volatile matter.....	282
Electric coal drills, hand-held, permissible, description.....	249	low-temperature oxidation products, significance.....	346
Electric detonators, lag, spread, and sustained ignition in.....	222	sleep-pitch, causes and control.....	287
Electric drilling machines, permissible, description.....	250	anthracite refuse, chemistry.....	208
Electric flashlights, permissible, tests.....	238	coal mine, annual reviews.....	198
Electric mine lamps, permissible, description, tests.....	236	electrical, cause.....	202-207
Electric rock drills, distributors, permissible, description.....	248	sealing and unsealing.....	200
Electric room heaters, permissible, description.....	247	extinguished with carbon tetrachloride, gases from, phosgene in, determination.....	194
Electric tunnel kits, fuel costs.....	354	gob, in German coal mine, extinguishing, fire-dump, ignition, by explosives.....	211
Electrical accidents, coal mines, reduction.....	255	Bureau of Mines research.....	103
Electrical equipment, investigation for safety, permissible, advantages.....	261	Flames, gases, study.....	98
Employment, coal mines, bituminous, discussion, data.....	263	Flame safety lamps, behavior, in mine atmospheres deficient in oxygen.....	125
Entries, back, rock dusting, methods.....	380	Flameless lamps, in mine atmospheres, fuel.....	121
Equipment, electrical, investigation for safety, safety, wider use, in mining.....	404	Flashed, in mine atmospheres, examination.....	244
Ethane, limiting high-temperature rotational partition function.....	307	Flame temperatures, natural gas.....	243
100.....	251	Flashed, permissible electric, tests.....	119
115.....	238	Fly-ash, dust, data, coal, washability curves, fly ash, emission, from chimneys, reduction.....	238
325.....	274	from spreader stokers, discussion.....	363
102.....	371, 373	prevention at Federal Heating Plant, Washington, D. C.....	308
101.....	308	Fracture, coal, Alabama.....	368, 370
118.....	67	Fuels, combustion products, sulfur in.....	68
144.....	339	domestic, coke, as, information for permissible flame safety lamps, discussion.....	338
280.....	243	Kilns, heat balances, charts.....	243
180.....	355	packaged, annual review.....	379
99.....	379	solid, dust-prevention treatment, sampling and analysis, standard methods, review.....	276
212.....	33	selection, for small consumers.....	33
194.....	359	today and tomorrow, review.....	359
194.....	21	Fuel beds, principles.....	21
202, 203.....	342	Fuel briquets, annual review.....	342
122, 123.....	379	Fuel costs, electric tunnel kits.....	379
229.....	354	Fuel efficiency, cement manufacture.....	354
226.....	406	Fumes, explosives, effect on health.....	193
230.....	193	Functions, thermodynamic, calculation, from spectroscopic data.....	113
227.....	347	Furnaces, hand-fired, down-draft, operation.....	347
231.....	318	Fusant, hydrogenation.....	318
193.....		Gases, combustion.....	
103.....	122	chlorotic, incomplete rotational excitation.....	122
98.....	13	effluent, from anthracite, hydrogen in, effect of time of contact.....	13
217.....	261	explosions.....	261
218-221.....	122, 123	flames, study.....	122, 123
235.....	122	from fires, extinguished with carbon tetrachloride, phosgene in, determination.....	122
228.....	45		

Gas, inflammability limits, studies  
zinc, analyzing, with Bureau of Mines  
with Bureau of Mines  
detection methods, 135, 137  
of Mines apparatus, 114  
information, 75  
protection against, 319  
sampling, 317  
Gas detectors, investigation, for safety, ac-  
tively and sedation energy, 318, 319  
Germany, coal mine, rob fire, extinguishing,  
with liquidizer, 323  
Glaseter pliomometer, 211  
Great Britain, coal dusts, explosibility tests, 74  
coal industry, production control, effects, 309  
Grainability, coal, Alabama, 318  
determination, 315  
methods, investigation, 320  
Grindability indexes, ball-mill, American  
coal, 323  
Ground movement, coal mine, 323  
Physics, 323  
Pittsburgh, studies, 324, 327  
Grundy coal field, Virginia, mining methods, 169

## II

Haldane apparatus, Bureau of Mines, gas anal-  
ysis with, 237  
Haulage, coal mines, bituminous strip, truck  
safety, rail, 201  
truck study, 255  
Haulage accidents, anthracite mines, preven-  
tion, 234  
Hazards coal ignition, by mine electric cir-  
cuits, 161  
mining dusts control, 341  
"nipping," when tramping coal-mine ma-  
chinery, reducing, 283  
pellet powder, reducing, 355  
Health, coal mining, promoting, by watering  
methods, 283  
Heat, insulation, discussion, 146  
insulation, in low-temperature oxidation of  
anthracite, 120  
Heat transmission, in small boilers, effect of  
soot, 131  
Hoisting Plant, Federal, Washington, D. C.,  
equipment and operation, 369  
smoke and fly-ash, reduction, 369  
Heating value, anthracite, effect of oxidation, 288  
Henry Eilen bed, Alabama, coal, washability, 208  
High Split bed, Kentucky, coal, carbonizing  
properties and petrography, 201  
Pennsylvania, petrographic constituents,  
hydrogenation, 329  
Hoists, room, permissible electric, description, 165  
Hoisting, men, State regulations, 146  
Hoisting ropes, mine, inspection and main-  
tenance, 120  
Hydrocarbon, combustion, mechanism, 146  
in internal-combustion engines, reactions, 120  
Hydrocarbon oils, aromatics and olefins in  
determining, sulfuric acid extraction  
methods, 37  
extraction with sulfuric acid, volume-physi-  
cal constants relationship, 314  
graphic analysis, 314  
Hydrogen, activated sorption, on chronic  
oxide gel, kinetics, 310  
dissociative adsorption, by copper, kinetic  
consequences, 281  
in gases, iron, auriferous, effect of time of  
oxidation, by bacteria, 116  
reactions, equilibrium constants, 116  
Hydrogen-oxygen explosion limits, equation,  
Pittsburgh, studies, 128  
Hydrogen-oxygen reaction, above upper ex-  
plosive limit, 133  
chemical kinetics, 118  
complex mechanisms, 124

## INDEX OF SUBJECTS

Hydrogen and oxygen, sensitized by nitrogen  
peroxide, explosion reaction, kinet-  
ics, 135, 137  
Hydrogen-burner-bureau equilibrium con-  
stants, relative values, 114  
Hydrogen: carbon ratio, coal, relation to vola-  
tile matter, 75  
Hydrogenation, anthraxylon, 319  
from bituminous coal, 317  
coal, 312  
artificial constituents, 318, 319  
bonded constituents, 319, 320  
chemistry, 323  
Pennsylvania, Pittsburgh bed, 323  
lars and pitches from, solubility, 311  
United States in investigations, 308  
fusain, 313  
oxygen-nitrogen-sulfur linkages, coal lique-  
faction by, 315  
petrographic constituents, High Split  
bed, 320  
Pittsburgh bed, 323  
Hydrogenation plant, coal, Bureau of Mines,  
description, 324, 327

I  
Ignition, electrical, mine gas, demonstrating, 169  
Bureau of Mines apparatus, 169  
Ignition temperature, anthracite, effect of  
carbon monoxide liberation, 286  
ethylene, in air and oxygen, 102  
Illinois, coal mines, mechanization, 160  
loading, accident-frequency rates, 160  
Impinger, Bureau of Mines, method, for dust  
sampling, description, 89, 90, 95  
Impinger method, for dust sampling, tech-  
nique, 91  
Indiana, Indiana No. 4 bed, coal, blends with  
Becky-bed coal, 91  
carbonizing properties and petrography, 205  
Saxon No. 1 mine, coal, carbonizing prop-  
erties and petrography, 205  
Industries, hazardous, application of inflam-  
mability limits, 107  
Inflammability, coal dusts, effect of fineness  
of coal, 97  
gaseous dustification products, from heated  
anthracite, 105  
Inflammability limits, application to indus-  
trial operators, 107  
ethylene, in air and oxygen, 102, 107  
gases and vapors, studies, 101  
Instruments, for coal-mine officials, familiarity  
and use, 169  
Insulation, heat, discussion, 341  
in reactions, hydrocarbons  
in mines and tunnels, State regulations, 131  
kneec in, 164  
131

J  
Jets, compressed air, for ventilating gassy  
mines, hazards, 187  
Jig, coal washing, Baum-Lyp, performance, 272  
pulsator-type, performance, 273

K  
Kentucky, Chesplit mine, carbonizing prop-  
erties and petrography, 201  
Consolidation mines, coal, carbonizing prop-  
erties and petrography, 207  
High Split bed, coal, carbonizing properties  
and petrography, 201  
Millers Creek bed, coal, blends with Pitts-  
burgh-bed coal, 207  
blends with Pocahontas-bed coal, 207  
carbonizing properties and petrography, 207  
Pocahontas bed, coal, blends with Millers  
Creek-bed coal, 207  
Pond Creek bed, coal, carbonizing properties  
and petrography, 203

Kilns, ceramic, down-draft, burning coal in...  
combustion data, review, 345  
electric tunnel, fuel costs, 352  
fuels, heat balances, charts, 354  
355  
rotary cylindrical, passage of solid particles, 296  
Kindling properties, coals, 332  
Klondyke mine, Alabama, coal, washability, 208  
Kneec, in internal-combustion engines, 131  
Kontimeter, for dust sampling, technique, 92

L  
Lamps, electric cap, in Alabama coal mines  
flame safety, behavior, in mine atmospheres  
deficient in oxygen, 244  
permissible, fuel, 243  
mine, permissible electric, description, 41  
tests, 245  
safety, investigation, 239  
Legislation, mine safety, mines, 163  
lighting, practices, coal mine, 237  
Liquefaction, coal, by hydrogenation, 313  
Loading, oxygen-nitrogen-sulfur linkages, 315  
buck, coal, to coal mines, review, 301, 303  
Loading equipment, mechanical, coal mines, 302, 305, 306, 307  
Longwall mining, methods, in coal mines,  
Middle Western States, 168  
Lower Kittanning bed, Pennsylvania, coal,  
carbonizing properties and petro-  
graphy, 204  
Lower Summerville coal, Utah, origin and  
petrographic composition, 40  
Lubricating oils, from ethylene, discussion, 307  
Lump coal, specific gravity, 77

M  
Machines, coal-cutting, bits, guarding, 262  
mobile, tonnage mined in, 308  
Machinery, coal-mine, tramping, reducing, 286  
"nipping," hazards, 286  
Manholes, combustibles in, investigations, 255  
ventilation, 83, 86, 87, 88  
natural, effect of holes in covers, 87  
effect of size, 88  
Man-trips, in bituminous-coal mines, falls, 167  
Massachusetts, Boston, manholes, combus-  
tibles, investigations, 83-86  
Mechanization, coal mines, bituminous, dis-  
cussion, 300, 304  
Illinois, 166  
increase, as shown by tonnage mined, 308  
progress, 308  
trends, as shown by sales of loading equip-  
ment, 308  
Merrittstown air shaft, Pennsylvania, sub-  
sidence, 105  
Methane, decomposition, role of methyl and  
methylene radicals, 100  
limiting high-temperature rotational par-  
tition function, 115  
Methane detectors, for sampling air in anthra-  
cite mines, use, 115  
Methane-oxygen low-pressure explosion limit,  
dependence on reaction-vessel surface, 127  
Methyl derivatives, from benzene, limiting  
high-temperature rotational partition  
function, 117  
Methyl radicals, role in decomposition of meth-  
ane, 115  
Methylene radicals, role in decomposition of  
methane, 100  
Middle Western States, coal mines, longwall  
mining methods, 168  
Middlings, table, Alabama, Colta washery,  
classification and testing, 270  
Millers Creek bed, Kentucky, coal, blends  
with Pittsburgh-bed coal, 207

Millers Creek bed, Kentucky, blends with  
Pocahontas-bed coal, 207  
Mines, See Anthracite mines; Coal mines.  
Mine atmospheres, deficient in oxygen, be-  
havior of flame safety lamps, 244  
Mine fans, observations, 190  
performance, experiments, 184  
Mine fires, annual reviews, 202-207  
electrical, cause, 200  
sealing and unsealing, 194  
significance of oxidation on volatile matter  
of anthracite, 194  
Mine gas, analyzing, with Bureau of Mines  
apparatus, 282  
with Bureau apparatus, 43  
detection, methods, 41  
electrical ignition, demonstrating, Bureau of  
Mines apparatus, 169  
information, 75  
protection against, 319  
sampling, 317  
Mine hoisting ropes, inspection and main-  
tenance, 120  
Mine lamps, permissible electric, description, 41  
electric, tests, 245  
Mine safety, legislation, mines, 163  
survey, electrical viewpoint, 163  
Mine Safety Board, decisions, 153, 154  
Mines 72 and 73, Pennsylvania, coal, carboniz-  
ing properties and petrography, 204  
Mine supply eses, coal mines, bituminous,  
mechanized, coal-mine officials, responsibil-  
ity, 280  
multiple-shift, in bituminous-coal  
mines, 176  
Mining Division, annual reports, 171, 173  
Monocoles, mounted, limiting high-temper-  
ature rotational partition function, 115-117  
Montour 10 mine, Pennsylvania, roof move-  
ment, study, 148  
Moynihan, coal, in coal mines, study, 148  
Pennsylvania, Pittsburgh district, Bureau  
of Mines studies, 177

N  
National Safety Competition, explosives acci-  
dents, reports, 226  
Natural-gas flames, temperatures and vertical  
gradients, 119  
New Mexico, coal, analysis, 47  
"Nipping," hazards, when tramping coal-  
mine machinery, reducing, 286  
Nitrogen, extraction of propylene flames with,  
100  
Nitrogen-oxygen-sulfur linkages, hydrogena-  
tion, coal liquefaction by, 315  
Nitrogen peroxide, oxygen and hydrogen sensi-  
tized by, explosion reaction, kinet-  
ics, 135, 137  
Nitrous oxide, thermodynamic functions, 108  
Nomenclature Division, annual reports, 9, 10, 17,

O  
Officials, coal-mine, instruments, familiarity  
and use, 169  
responsibility in mechanized mining, 176  
Ohio, coal mines, explosions, 210  
Oil, from coal, discussion, 336  
light, composition, 335  
Olefin, in hydrocarbon oils, determining, sul-  
furic acid extraction methods, 37  
reactions, equilibrium constants, 116  
Opaque matter, in split coal, origin, 61  
Oregon, Coos Bay, coal, stoker tests, 362  
Orsat apparatus, Bureau of Mines, for analyz-  
ing mine gases, 309, 402  
Outcrop, per man, coal mining, discussion, 367  
Overheat stoker, domestic, burning coals,  
illuminated, carbon monoxide  
oxidation tests, 367  
effect of time of contact on hydrogen in  
effect on burning value, 281  
effect on volatile matter, 282



Oxidation, anthracite, low-temperature, heat liberated..... 283  
 coal, at moderate temperatures..... 284  
 at storage temperatures, effect on carbonization..... 285  
 Oxidation products, low-temperature, from anthracite mine fires, significance, from Oxidation reaction, coking coal, rates..... 287  
 Oxygen, at high temperatures from ozone decomposition, heat capacity..... 288  
 diethyl ether in, ignition temperature..... 289  
 inflammability limits..... 290  
 in mine atmospheres, deficiency, behavior of flame safety lamps..... 291  
 Oxygen-carbon monoxide reaction, dry and water-catalyzed, at and above explosion limit..... 292  
 Oxygen-deuterium reaction, chemical kinetics..... 293  
 Oxygen-nitrogen explosion limits, equation..... 294  
 Oxygen-hydrogen reaction, above upper explosion limit..... 295  
 chemical kinetics..... 296  
 sensitivity..... 297  
 sensibility by nitrogen peroxide, kinetics..... 298  
 dependence on reaction-vessel surface..... 299  
 Oxygen-nitrogen-air linkages, hydrogeneration, coal liquefaction by..... 300  
 Ozone, explosive, oxygen at high temperature, heat capacity..... 301  
 P  
 Packaged fuel, annual review..... 302  
 Paper bags, rock-dust barrier, using..... 303  
 Paraffin, reactions, equilibrium constants..... 304  
 Paraffin hydrocarbons, combustion..... 305  
 Particles, solid, passage through rotary cyclone..... 306  
 Peat, annual review..... 307  
 Pellet powder, hazards and accident experience..... 308  
 Peninsular, anthracite, annual review..... 309  
 anthracite colleries, ventilation..... 310  
 bituminous coal, analyses..... 311  
 Gracible mine, roof movement, study..... 312  
 Experimental coal mine, Bureau of Mines, work, review..... 313  
 High Split bed, petrographic constituents, hydrogeneration..... 314  
 Lower Kittanning bed, coal, carbonizing properties and petrography..... 315  
 Merrittstown air shaft, subsidence, mines 72 and 73, carbonizing properties and petrography..... 316  
 Montour 10 mine, roof movement, study, northeastern, anthracite region, mines, water pumped from..... 317  
 Pittsburgh bed, coal, blands with Millers Creek-bed coal..... 318  
 carbonizing properties and petrography..... 319  
 hydrogeneration..... 320  
 petrographic constituents, hydrogeneration..... 321  
 coal mine, ground movement..... 322  
 coal pillars, strength..... 323  
 Pittsburgh district, roof movement, Bureau of Mines study..... 324  
 Pittsburgh Terminal No. 9 mine, Pennsylvania, coal, carbonizing properties and characteristics..... 325  
 measurement..... 326  
 relation to quality of coke..... 327  
 Plastometer, flaws, for measuring plastic flow..... 328  
 Glessner, for measuring plastic properties of coal..... 329  
 Pocahontas bed, West Virginia, coal, carbonizing properties and petrography..... 330  
 Pond Creek bed, Kentucky, coal, carbonizing properties and petrography..... 331  
 Post drills, permissible electric, description..... 332  
 Powder, ball, hazards and accident experience..... 333  
 Powellton A bed, West Virginia, coal, carbonizing properties..... 334  
 Power circuits, high-tension, in coal mines, installation..... 335  
 Power drilling, in underground bituminous coal mines, review..... 336  
 Pratt bed, Alabama, coal, washability..... 337  
 Preparation, coal, Alabama..... 338  
 Processing, coal..... 339  
 Production, control, coal industry, Great Britain, effects..... 340  
 Propane, limiting high-temperature rotational partition function..... 341  
 Properties, coal, as sampled, chemical, physical..... 342  
 relation of microscopic composition to..... 343

Propylene, explosibility..... 100  
 limiting high-temperature rotational partition function..... 101  
 Propylene flames, extinction, by diluting with nitrogen, and carbon dioxide..... 102  
 Pulsator-type coal-sustaining jet, performance..... 103  
 Puritan mine, Colorado, subbituminous coal, carbonizing properties..... 104  
 Pyrolysis, ethane..... 105  
 R  
 Rail haulage, in bituminous-coal strip mines, comparison with truck haulage..... 106  
 Reactions, chemical, activated, complex in, statistical mechanical treatment..... 107  
 Reflector buttons, use, in coal mines..... 108  
 Refractories, thermal conductivity, determination..... 109  
 Refuse, anthracite, fires in, chemistry..... 110  
 Bureau of Mines..... 111  
 Resources, coal, conservation..... 112  
 Resins, hydrogeneration..... 113  
 Resonance, development..... 114  
 Resonators, change..... 115  
 Respirators, permissible, list..... 116  
 Asphyxiating, permissible, list..... 117  
 Respiratory protective devices, discussion, permissible, list..... 118  
 Detector, carbonization, Bureau of Mines, experiments..... 119  
 Lock, falls, in man-traps, bituminous-coal mines..... 120  
 Rock-dust barrier, using paper bags, tests..... 121  
 Rock-dust distributors, permissible electric, description..... 122  
 Rock dusting, back entries, methods..... 123  
 Trends..... 124  
 Roof, conditions, effect of rapid extraction of pillars..... 125  
 falls, effect of rapid extraction of coal-mine pillars..... 126  
 Roof movement, in coal mines, study, Pittsburgh district, Pennsylvania, Bureau of Mines studies, Pennsylvania, Bureau of Mines, permissible electric, description..... 127  
 Room hooks, permissible electric, description..... 128  
 Ropes, hoisting, mine, inspection and maintenance..... 129  
 S  
 Safety, coal mine, promoting, by watering methods..... 130  
 trends..... 131  
 coal-mine haulage, suggestions..... 132  
 in limiting anthracite mines, procedure..... 133  
 mine, legislation, milestones..... 134  
 Safety equipment, wider use, in mining..... 135  
 Safety lamps, flame, behavior, in mine atmospheres deficient in oxygen..... 136  
 improved, description..... 137  
 investigation..... 138  
 Safety survey, coal mines, electrical viewpoint..... 139  
 Sampling, dust, with Kontimeter, technique, with Bureau of Mines midge lamp, technique..... 140  
 Sampling methods, coal..... 141  
 Solid fuels, by countries, review..... 142  
 Saxton No. 1 mine, Indiana, coal, carbonizing properties and petrography..... 143  
 Sewell bed, West Virginia, coal, blends with Altoona, coal, effects..... 144  
 carbonizing properties and petrography..... 145  
 Shaft-bottom lay-outs, at coal mines, description..... 146  
 Shock wave velocity, not affected by rate of explosive detonation..... 147  
 Shrinkage, low-temperature coke, on heating to higher temperature..... 148  
 Signaling devices, permissible, tests..... 149  
 Size composition, coal, interpretation..... 150  
 Slacking characteristics, coal, Deaver region, Colorado..... 151  
 Slope-bottom lay-outs, coal mine, description, Snook, from spreader stokers, discussion, prevention, at Federal Heating Plant, Washington, D. C..... 152  
 Snook, description, boiler plants, importance, fundaments..... 153  
 Papers, contacts..... 154  
 Soet, effect on heat transmission in small boilers..... 155  
 South Central States, bituminous coal, strip mining..... 156  
 Specific gravity, coal..... 157  
 Splint coal, rock-matter, origin..... 158  
 Spores, coal, sporotriches..... 159  
 Hydrogenation..... 160  
 Spreaders, stokers, fly ash from, discussion, forced-draft, operation..... 161  
 operation..... 162  
 smoke from, discussion..... 163  
 State geological surveys, relation to Bureau of Mines coal investigations..... 164  
 State regulations, hoisting men, internal-combustion engines, in mines and tunnels..... 165  
 Steady-state rate, chain reaction, for chain destruction, at walls of varying efficiencies..... 166  
 Stereoisomerism, new type, description..... 167  
 Stoker, domestic overfeed, burning coal, tests, spreader, fly ash from, discussion, forced-draft, operation..... 168  
 operation..... 169  
 Smoke from, discussion..... 170  
 Storage temperatures, oxidation of coal at, effect on carbonization..... 171  
 Strip mining, bituminous coal, in Central and South Central States..... 172  
 truck vs. rail haulage..... 173  
 Study..... 174  
 Subbituminous, coal mine, physics..... 175  
 Substitutes..... 176  
 Merrittstown air shaft, Pennsylvania..... 177  
 Pittsburgh bed, Pennsylvania..... 178  
 Sulfur, discussion, constants..... 179  
 forms, in insoluble residues from hydrogeneration..... 180  
 in combustion products of fuels..... 181  
 Sulfur compounds, in air, effects..... 182  
 Sulfur monoxide, free energy..... 183  
 Sulfur-oxygen-air linkages, hydrogeneration, coal, hydrogeneration by..... 184  
 Sulfuric acid, extraction methods, for decarbonizing..... 185  
 extraction of hydrocarbon oils, in hydrocarbon oils..... 186  
 physical constants relationship..... 187  
 Swelling, coal..... 188  
 during coking, determination..... 189  
 T  
 Table middlings, Alabama, Colts washer, classification and tabling..... 190  
 Tars, from coal hydrogeneration, solubility..... 191  
 Tar acids, determining, extraction methods..... 192  
 Tar bases, determining, extraction methods..... 193  
 Technology, coal, advances..... 194  
 Bureau of Mines work..... 195  
 coal mining..... 196  
 Technologic Branch, coal, research and technologic work..... 197  
 Telephones, permissible, tests..... 198  
 Temperatures, flame, natural gas..... 199  
 Terminology, coal, standardization..... 200  
 Testing, coal..... 201  
 Tetramethylethylene, limiting high-temperature rotational partition function..... 202  
 Tetramethylmethane, thermodynamic functions..... 203  
 Tetramine, absorption of carbon dioxide by..... 204  
 Texas, New London, school building, explosion..... 205  
 Timbering, anthracite mines, safe procedure..... 206  
 Triethanolamine, absorption of carbon dioxide by..... 207

Trimethyl ethylene, limiting high-temperature rotational partition function..... 146  
 Truck haulage, in bituminous-coal strip mines, comparison with rail haulage..... 151  
 study..... 153  
 Tunnels, internal-combustion engines, State regulations..... 164  
 Tunnel kilns, electric, fuel costs..... 354

## U

United States, coal, ball-mill grindability indexes..... 51, 52  
 typical, classification chart..... 51, 52  
 coal dusts, explosibility tests..... 387  
 coal industry, reduced output, discussion..... 385  
 coal market, in Canada..... 374  
 coal mines, accidents..... 202-208  
 gas explosions, review..... 202-207  
 fire, annual review..... 207  
 lighting practices..... 378  
 explosives, production..... 295  
 Upper Banner bed, Virginia, coal, carbonizing properties and petrography..... 294  
 Upper Kilmanning bed, Pennsylvania, coal, carbonizing properties and petrography..... 229  
 Utah, coal mines, blasting practices..... 49  
 explosives accidents..... 50  
 Lower Summysto coal, origin and petrography..... 50  
 Utilization, coal.....

## V

Vapors, inflammability limits, studies..... 96  
 Vapor pressure, xylenes and nesitylene..... 337  
 Ventilation, anthracite collieries, Pennsylvania, coal mine..... 82, 87, 88  
 auxiliary..... 101  
 observations..... 102  
 relation to health and safety..... 100  
 manholes, investigations..... 193  
 requirements, Alabama, law..... 186  
 Ventilation doors, coal mine, Mino Safety Board decision..... 153  
 Virginia, Buchanan mines, coal, carbonizing properties and petrography..... 296  
 Clinchfield No. 9 mine, carbonizing properties and petrography..... 295  
 Clintonwood bed, coal, carbonizing properties and petrography..... 296  
 Grundy coal field, mining methods..... 160  
 Upper Banner bed, coal, blends with Beckley-bed coal..... 295  
 carbonizing properties and petrography.....

Volatile matter, in anthracite, effect of oxidation..... 232  
 In coal, relation to hydrogen: carbon ratio..... 75  
 Voltago, adequate, for coal-mine distribution systems..... 241

## W

Wages, anthracite industry, reduction..... 401  
 Washability, coal, Alabama, America bed..... 269  
 Black Creek bed..... 271  
 Henry, Ethen bed..... 268  
 Pratt bed..... 269  
 Washcook bed..... 268  
 Washability curves, coal, explanation, float-and sink data, explanation..... 277  
 Washington, coke, properties..... 274  
 Water, calcining dust in bituminous-coal pumped from Pennsylvania anthracite mines..... 195, 196  
 Water-gas shift reaction, cobalt-copper catalyst for, preparation..... 265  
 Watering methods, coal mines, promoting health and safety by..... 328  
 West Virginia, Alma bed, coal, blends with Sewell-bed coal, effects..... 161  
 carbonizing properties..... 202  
 Beckley bed, coal, effects..... 289  
 blends with high-volatile coals, effect, on carbonization products..... 301  
 blends with Indiana No. 4-bed coal, effects with Upper Banner-bed coal..... 285  
 carbonizing properties..... 289  
 Cedar Grove bed, coal, carbonizing properties..... 289  
 coal, carbonizing properties..... 289  
 Dooley bed, coal, carbonizing properties..... 289  
 Eagle bed, coal, carbonizing properties..... 289  
 Pocalpines bed, coal, carbonizing properties..... 289  
 Powellton A bed, coal, carbonizing properties..... 289  
 Sells bed, coal, blends with Alma-bed coal, effects..... 289  
 carbonizing properties..... 289  
 Wind, velocity, effect on natural ventilation of manholes..... 202  
 Woodstock bed, Alabama, coal, washability..... 82  
 Wyoming mine, West Virginia, coal, carbonizing properties and petrography..... 263  
 X  
 Xylenes, vapor pressure..... 337  
 Y  
 Yolande No. 6 mine, Black Creek bed, Alabama, coal, washability..... 271