INDEX

A

Achey, H. P., logs from, 352 Aftonian and Nebraskan stages in Crawford county, 304; in Lucas county, Age of limestones of Crawford county, 295Air preheaters, use of, 86 Alluvial soils, character, 346; in Crawford county, 346; in Lucas county, Alluvium in valleys, 118, 288 Altitude, of rock surface in Crawford county, 302; in Lucas county, 127 Altitudes, bench marks for, 368; datum for, 369; from railway profiles, 365; Gannett's Dictionary of, 365; highest and lowest, 377; in Crawford county, 268; in Iowa, James H. Lees, 363; in Lucas county, 113; sources for, 365 Anderson, C. O., work of, in coal, 180 Anhydrite, use of, 25 Annual Report, George F. Kay, 7 Arcadia, wells near, 296 Area and location of Crawford county, 243; of Lucas county, 105 Areas of drainage basins in Crawford county, 292; in Lucas county, 114 Arion, gravel and sand near, 360; Riddell pit, 331; water supply, 352 Arkansas, analyses of coal from, 78 Ash and sulphur content of Iowa coal, 92; studies of, 99 Ashley, George H., cited, 81 Aspinwall, exposures near, 313, 324 Audubon, artesian well at, 300

В

Bain, H. F., cited, 125, 246, 257, 296, 302 Barnhoff well, strata in, 354 Bassett, J. R., early settler, 244 Bates, work of, in coal 176 Bench marks, altitudes for, 368 Benches in Crawford county, 266; in Lucas county, 117 Berne, exposure near, 323 Beyer and Williams, cited, 220; and Wright, cited, 220 Big Hill mine at Lucas, 166, 180, 186, Biloxi datum plane, 371, 373 Bluff formation, origin, 244 Bowlders, Kansan, in Lucas county, 173 Boyer, exposures near, 306 Boyer valley, benches on, 267; character of, 260, 274; exposures in, 305; grav-

els in, 330; history of, 275; tributaries of, 285
Brick plants in Crawford county, 361; see also Clay
Briggs drift mine in Lucas county, 174
Buck creek, character, 286
Buck Grove, exposures near, 327
Buffalo creek, character, 287
Butler, K., cited, 81
Byers, H. L., work of, in coal, 176

C

Cackler mine, Lucas county, 180; section of, 237 Cairo datum plane, 373 California, well at, 301 Calvin, S., cited, 123, 127, 246, 284, 295, Campbell, M. R., estimate of coal area, Cap rock in Lucas county, 151 Carbonization at low temperature, 100; process for Iowa coal, 95 Carman, J. E., cited, 279, 303, 333 Carney, K. G., analyses from, 79, 80 Carr, Byron O., work of, in coal, 174 Carroll county, wells in, 294 Cedar creek drainage, 120 Cement, production in Iowa, 58; in 1925, 12; in 1926, 36 Centerville, well at, 129; coal, character of, 77 Central Iowa Fuel Co., acknowledg-ments, 221; analyses from, 199, 202; mines of, 178, 186; record of shaft, 153, 155 Chamberlin and Salisbury, cited, 81 Characteristics of Iowa coals, 76 Chariton, coal mining near, 177, 186; depth to St. Peter at, 206; quarries near, 219; section near, 159; water supply, 208 Chariton Conglomerate in Lucas county, 167, 218 Chariton Co-operative Coal Co., mine of, 176 Chariton river valley, age of, 107, 115; drainage basin of, 114; gradient of, 114; strata in, 115 Charter Oak water system, 351 Chemical analyses of Iowa coals, 200 Cherokee beds, character of, 143; in Lucas county, 144 Chester strata in Lucas county, 140 C., B. and Q. R.R. reservoir near Chariton, 210

C., R. I. and P. Ry., elevations by, 370;
reservoir in Lucas county, 210
C. and N. W. Ry. Co., water stations,

348

Clays in Crawford county, 361; in Lucas county, 216; operators in 1926, 17; wares in Iowa, 60; prices of, 39; production in 1925, 13; in 1926, 37

Cleveland mine, analyses from, 201; see also Old Cleveland, New Cleveland

Clinton silt loam, 214

Coal, age of, and character, 66; analyses and tests, 78, 79, 97-91, 199-202; burning of, 77; in domestic furnaces, 94; cover of, and character, 66; dry cleaning of, 94; gasoline from, 97; geological conditions of formation, 67; haulage of, 19; Iowa, areas and characteristics of, 65, 82, 92; burning, 82; classification of, 99; coke from, 96; steam production, 82; oils from, 96; researches on, 91, 94; storage of, 98; use of, 93; at University, 97; laminæ in, 77; lump, analyses of, 78; methods of mining, 19; in Lucas county, 187; powdered, use of, 99; production of, 75, in 1925, 18, in 1926, 41; in Lucas county, 174, 180, 182; prospecting for, 184; situation and nature of, 183; steam, analyses of, 79; test at Moline, 87; value of, 56; washing of, 94

Coal beds, extent of, 74; formation in geosyncline, 132; in Crawford county, 361; in Lucas county, 173; Measures, surface in Lucas county, 130, 138; water from, 203; mines in Lucas county, 192; mining, history of, in Lucas county, 173; operators, 22; swamps, character of, 70; materials in, 71

Coal Age, article in, 19
Coke from Iowa coal, 96
Coking properties of coal, 96
Colorado stage, character of, 73
Consequent drainage, 272
Consolidated Indiana Co., in Lucas coun-

ty, 187

Consolidation Coal Co., in Lucas county, 187

Corydon, well at, 129 Country wells in Crawford county, 353 Cox well, section of, 295 Crawford, Wm. H., county named for,

243

Crawford county, Aftonian beds in, 304; age of limestones in, 295; age of sandstones in, 296; altitudes in, 268; areas of drainage basins, 292; artesian well in, 297; benches in, 266; brick plants in, 361; coal in, 361; Cretaceous beds in, 296; deposits of uncertain age, 319; Des Moines beds in, 295; drainage of, 272; eastern province of, 259; gravels in, 328; height of land in, 247; his-

tory of, 243; Kansan and Yarmouth stages in, 321; location and area of, 243; loess in, 338; Missouri beds in, 295; Nebraskan and Aftonian stages in, 304; peat in, 316; Pleistocene in, 302; profile across, 271; rainfall in, 357; sand and gravel in, 359; soils of, 344; springs in, 357; stratigraphy of, 292; streams, water from, 357; topography of, 247; underlying formations, 293; water supply of, 346; wells in, 294, 346; western province of, 264; Wisconsin gravels in, 338; Yarmouth in, 321

Cretaceous beds in Crawford county, 296; coals, 66; system, extent and character of, 73 Crop yield in Lucas county, 214 Cutting power of streams increase in

Cutting power of streams, increase in, 288

D

Dakota stage, character of, 73 Daniels, Evan, mine of; 180, 197; section Datum for altitudes, 369 Davidson, G. M., analyses by, 349 Davie, W. A., wells by, 356
Dearborn Drug and Chemical Works,
analyses by, 350 Deloit, exposures near, 319 Denison, J. W., town named for, 243 Denison, clay pit at, 342, 361; exposures near, 320; Mill pit near, 329; sand at, 360; water supply, 347; well at, 297 Denison Brick Co., section, 342 Deposits of uncertain age, Crawford county, 319 Des Moines, well at, 29 Des Moines City Ry., plant of, 84; tests by, 88 Des Moines Dept. Streets, altitudes from, 368 Des Moines river, elevations on, 370 Des Moines series, base of, 131; extent of, 72; in Crawford county, 295; in Lucas county, 143; surface of, in Lucas county, 137; thickness of, in Lucas county, 138 Devonian surface, character, 131 Dobson, B., early settler, 244

Dobson, T., early settler, 244
Dow, S. E., early settler, 244
Dow City, exposures near, 337
Drain tile in Iowa, 14
Drainage basins, areas of, in Crawford county, 292; in Lucas county, 114
Drainage of Crawford county, 272; of Lucas county, 113
Drift mines in Lucas county, 198
Drift soils in Lucas county, 213
Drill sections in Lucas county, 222
Dunham, C., early settler, 244

Dunlap, well at, 301

East Boyer river, character of, 260, 283 Eaton well, Lucas county, 187; section of, 166 Eikenberry, Daniel, mine of, 175 Elevation of Nebraskan gumbotil plain, Elevations, list of, in Iowa, 377; see also Altitudes English or Wild Cat creek, 119; coal in valley of, 152 Eocene coals, 66 Erosion and deposition, effects of, 264; processes of, 257

Fertilizers in Iowa, 64 Fix, Louis R., work of, in coal, 174 Fleming, B. P., Possible Researches in Iowa Coal, 91 Forest denudation, result of, 216 Fort Dodge, Des Moines & Southern Ry., plant of, 84 Fort Scott beds in Lucas county, 163 Fossils in Lucas county, 139, 163 Franklin well, strata in, 354 Friends creek, character of, 286 Fuel, pulverized, use of, 85, 99 Furnaces and grates, designs of, 82 Furnaces for Iowa coals, domestic, 95

Gannett's Dictionary of Altitudes, 365 Gas, natural, production in 1925, 34; see Oil Gas and oil possibilities, 63 Gasoline from coal, 97 Geology of Crawford county, James H. Lees, 239; Lucas county, A. L. Lugn, Geosyncline, coal formation in, 132; in Mississippi valley, 132 Gilbert, G. K., cited, 122, 259 Glacial drift soils in Lucas county, 213 Glaciers in Crawford county, 303 Goben Coal Co., mine of, 180 Grates and furnaces, designs of, 82 Gravels, character, 328; in Boyer valley, 330; in Crawford county, 328; in Lucas county, 217; in Nishnabotna valley, 331; origin and age of, 332; see also Sand Green, A. C., data on coal from, 361 Green and Son, brick plant of, 361 Green and Ward clay pit, section, 341, Greene and Hinds, cited, 125, 126 Ground water in Lucas county, 203 Grundy clay loam, 214 Grundy silt loam, 214 Grundy silty clay loam, 214 Gumbotil, as soil in Lucas county, 213;

character of, 169, 303; concentrate, 323; in Crawford county, 303 ff; in Lucas county, 169; near Wall Lake, Gumbotils, two on one slope, 327 Gypsum, production of, 59; in 1925, 24; in 1926, 44

н

Haven, William, work of, in coal, 174, Heating value of Iowa coal, 92 Height of land in Crawford county, 247 Henrietta formation, character, 143; in Lucas county, 162; near Chariton, 157 Herring well, strata in, 355 Highest and lowest points in Iowa, 377 Hinds, Henry, cited, 81, 186 Hinds and Greene, cited, 125, 126 Hinman, Jack J., Jr., analysis by, 347 History of Crawford county, 243 Hixson, A. W., cited, 81 Hoffard, Frank, cited, 294 Hollingsworth, E. A., work of, in coal, 180 "Holmes" coal field, Lucas county, 187 Holstein, well at, 301 Howell, J. V., cited, 220

Illinois, analysis of coal from, 79 Illinois Agr. Exp. Station, cited, 211 Illinois Power and Light Corp., tests by, Indian creek, Sac county, history of, 275 Inland Fuel Co., analyses from, 199; work of, 177 Iowa, altitudes in, 363; drain tile in, 14; highest and lowest points in, 377; list of elevations in, 377; topographic map of, 376 Iowa Coal, Areas and Characteristics of, James H. Lees, 65; fields, age of, 66; for Steam Production, T. A. Marsh, Iowa Experiment Station, cited, 345 Iowa Geol. Survey, altitudes from, 368; mapping by, 373 Iowa Nebraska mine, 179, 186 Iowa Power & Light Co., Des Moines plant of, 84 Iowa Railway and Light Co., plant of, 84 Iowa Soil Survey, cited, 211 Iowa State College, altitudes from, 367; analyses by, 201, 347 Iowa Weather and Crop Service, cited, 214, 357

Jackson, H. L., work of, in coal, 180 Jeffery, E. C., cited, 65 Jones, Wesley, work of, in coal, 174

Kansan and Yarmouth stages in Crawford county, 321; bowlders in Lucas county, 173; drift, character, 170, 321; in Crawford county, 321; in Lucas county, 169; near Manilla, 325; gumbotil, age of, 127, 304; character, 321 Kay, F. H., cited, 81 Kay, George F., cited, 126, 127, 171, 173, 246, 304, 309, 311, 312, 316, 321, 323, 326, 331, 333, 338; Annual Report of, 7; Rock Resources of Iowa, 51; work in Lucas county, 106 Kentucky, analyses of coal from, 78, 80 King well, strata in, 354

Kiron, exposure near, 322

Ladow shaft, Lucas county, 176 La Turno, J. L., brick plant of, 361 Laub, H. C., early settler, 244 Lees, James H., acknowledgments, 221; Altitudes in Iowa, 363; cited, 81, 174, 301, 338; Geology of Crawford county, 239; Iowa Coal Areas and Characteristics of Iowa Coal, 65; Mineral Production in Iowa in 1925 and 1926, 9,

Lime, see Limestone Limestone, age of, in Crawford county, 295; and sandstone in Lucas county, 218; production in 1925, 26; in 1926, 45; value of, 63; operators, 28 Lindley silt loam, 214

Location and area of Crawford county,

243; of Lucas county, 105 Loess, age of, 127, 339; character of, 341; effect on topography, 264; in Crawford county, 338; in Lucas county, 127, 169; origin, 339; relations of, 342; soils, character, 213, 345; in Crawford county, 345; in Lucas county, 213

Logan, limestones at, 295 Lord, N. W., analyses by, 201 Lorensen well, strata in, 353 Lower coal, character of, 183; elevation of, 133; in Lucas county, 144 Lowest and highest points in Iowa, 377 Lucas, mines at, 166, 179, 186; analyses

from, 201; sections near, 160, 232 Lucas county, Aftonian topography of, 108; alluvial soils in, 213; altitudes in, 113; basins of Lower coal in, 186; bowlders in, 173; Chariton conglomerate in, 167, 218; Cherokee formation in, 144; Chester strata in, 140; clay in, 216; coal, analyses and tests, 199; beds in, 145 ff, 173; mines, 192; mining methods, 187; present holdings of, 186; production in, 174, 180, 182; columnar section of, 142; crop yield in, 214; depth to St. Peter sandstone, 206; Des Moines beds in, 143;

Des Moines surface in, 137; drainage, age of, 121; drainage history of, 113; drift mines, 198; drill sections in, 222; Economic geology of, 173; Fort Scott beds in, 163; fossils in, 163; geological terms used, 125; Geology of, A. L. Lugn, 101; glacial drift soils in, 213; ground water in, 203; gumbotil in, 108, 169; Henrietta formation in, 162; history of coal mining in, 173; Kansan drift in, 169; Kansan gumbotil in, 169; Kansan plain, remnants in, 108; location and area, 105; loess soils in, 213; Mississippian surface in, 134; Mississippian system in, 139, 150; Nebraskan drift in, 170; Nebraskan gumbotil in, 171; Nebraskan gumbotil plain in, 107; oil in, 220; Paleozoic history and structure, 127; Peorian loess in, 108; Pleasanton formation in, 167; Pleistocene beds in, 169; Pliocene surface, 107; precipitation in, table of, 204; preglacial surface, 107; rainfall in, 203; reservoirs in, 208; road material in, 220; sand and gravel in, 217; sandstone and limestone in, 218; septaria in, 163; soil, waste in, 215; soils and soil conservation in, 210; soils in 'Southern Iowa loess', 213; springs in, 206; stratigraphy, 123; St. Louis strata in, 140; Sto Convictor for the constraint in 120; strate in, 120; soils and soil conservation in the strate in the 140; Ste. Genevieve formation in, 139; streams, 203; streams, water in, 121; table of temperatures in, 205; thickness of strata in, 129; topographic analysis of, 112; topographic maps of, 113; topography of, 106; typical wells in, 207; unconformities in, 134; Warsaw strata in, 140; water supply of, 203

Lugn, Alvin Leonard, Geology of Lucas County, 101 Lysaght, J. A., analyses by, 80

McAhren, G., pit, Deloit, 330 McCaffery Brothers well, strata in, 353 McHenry, M., early settler, 244 Macbride, T. H., cited, 246, 248, 278 Mallory, S. H., work of, in coal, 175 Malone, W. M., work of, in coal, 180 Maloney, J. H., coal prospect of, 361 Manilla, brick plant at, 361; Kansan drift near, 325; water supply, 352 Manning, exposures near, 310
Maple Block Coal Co. in Lucas county, 187 Mapping by U. S. Geological Survey, Maps, see Topographic Maps Marsh, T. A., cited, 79, 81; Use of Iowa Coal for Steam Production, 82 Mason, J., early settler, 244 Melcher, mine at, 180

INDEX 555

Memphis datum plane, 370, 373 Methods of coal mining in Lucas county, 187 Metric system, conversion of, 372 Meyers, F. W., cited, 243 Mill pit near Denison, 329, 360; fossils in, 329, 337 Miller, B. L., cited, 126 Miller, W. J., cited, 294, 296 Miller well, strata in, 354 Milwaukee Electric Bailway Light & Power Co., tests by, 85 Mine dump waste as road metal, 220 Mineral production in Iowa in 1925 and 1926, 9, 55, 56; in 1926, 35 Mines, coal, in Lucas county, 192 Mining, possible depth of, 75 Mississippi Valley, geosyncline in, 132 Mississippian surface in Lucas county 130, 134; system in Lucas county, 139, 150 Mississippi River Com., altitudes from, 366; bench marks of, 369 Missouri-Mississippi watershed, 247 Misouri River Com., altitudes from, 366; bench marks of, 370 Missouri series, character of, 73, 295; in Crawford county, 295 Missouri Valley, strata near, 295 Moberly sandstone, origin, 126 Moisture content of Iowa coal, 92 Moline, coal tests at, 87 Monroé county, No. 10 well in, 129 Moody, work of, in coal, 176 Mormon Trace road, 108 Mystic vein, character of, 93

Nebraskan and Aftonian stages in Craw-

ford county, 304; drift, in Lucas county, 127, 170; thickness of, 318; gum-

botil, age of, 127; in Crawford county, 304 ff; in Lucas county, 171; near Boyer, 307; gumbotil plain, elevations

New Cleveland, coal mining near, 177 Nicholson Produce Co., water supply, 350 Nishnabotna valley, gravels in, 331

Naeve well, strata in, 355

of, 316

Nodaway coal, extent of, 73; mining of, Norton, W. H., cited, 128, 251, 297, 301 Norwood, Josh, work of, 178 Norwood, mine near, 180 Old Cleveland mine, 186; section of, 165 Oil and gas, 63; possibilities, 63 Oil in Lucas county, 220 Oils from Iowa coal, 96 Olin, H. L., analyses by, 202; cited, 81; studies on Iowa coal, 99; tests by, 80 Onawa, well at, 295 Osgood, C. F., work of, 187 Osgood, J. C., work of, in coal, 174, 177

Oskaloosa, well at, 129 Otter creek, Crawford county, character, Otter creek, Lucas county, drainage area, 116

Paleozoic deposition in Lucas county, 132 Panora coal in Lucas county, 144 Paradise creek, character, 287 Parr, S. W., cited, 81 Pearce, J. N., cited, 304 Peasley, J. C., work of, 176 Peat in Crawford county, 316 Pella, well at, 129 Pennsylvanian system, base of, 131; coal in, 66; water in, 203; time, climate of, 69; conditions in, 68; geosyncline in, 133; plants of, 69 Peorian loess, 127, 339; see also Loess Petroleum, see Oil Pirsson and Schuchert, cited, 81 Pleasanton formation in Lucas county, 167; deposition in, 133 Pleistocene deposits in Crawford county, 302; in Lucas county, 139, 169 Porter creek valley, exposures along, 306; gravels in, 331 Possible Researches in Iowa Coal, B. P. Fleming, 91
Potter, J. T., work of, in coal, 174 Precipitation in Crawford county, table of, 358; in Lucas county, table of, 204 Preheaters, air, use of, 86 Prentice, F., early settler, 244 Profiles across Boyer valley, 274; across Crawford county, 271; in Lucas county, 109 ff; railway, altitudes from, 365 Providence Western Land Co., settled Crawford county, 243 Pulverized coals, Iowa, 95; tests of, 88

Raccoon river, history of, 276 Railroad elevations, data for, 373; officials, altitudes from, 365; profiles, altitudes from, 365 Rainfall in Crawford county, 357; in Lucas county, 203 Ramsey, George, work of, in coal, 176 Red Rock sandstone, origin, 126 Reservoirs in Lucas county, 208 Rickert, Henry, wells by, 355 Ricketts water system, 351 Riddell sand pit, Arion, 331 Road material in Lucas county, 220; mine dump waste as, 220; see Sand and Gravel Rock Island Mfg. Co., tests by, 87 Rock Resources of Iowa, George F. Kay, Rock surface, altitude of, 302 Rocks, character of, 51; economic importance of, 54

Rogers, H. O., article by, 19 Room and pillar method of mining, 76, 187

S

St. John, Orestes H., cited, 144, 147, 152, 157, 174, 244; work in Crawford county, 244; in Lucas county, 106 St. Louis strata in Lucas county, 140 St. Peter sandstone, depth of, at Chariton, 206; at Denison, 299; in Lucas county, 206; surface, character, 131 Ste. Genevieve formation in Lucas county, 139 Sag valley near Wall Lake, 275 Salisbury and Chamberlin, cited, 81 Sand and gravel in Crawford county, 359; in Lucas county, 217; producers, 32; production, 61; in 1925, 29; in 1926, 47 Sandstones in Crawford county, age of, 296; and limestone in Lucas county, 218 Savage, T. E., cited, 77, 81 Schleswig water system, 351 Schuchert and Pirsson, cited, 81 Science, article in, 65 Sea level, mean, 369 Septaria in Lucas county, 163 Shelby loam, 214 Shimek, B., cited, 126, 246, 268, 295, 302 Shortwall mining methods, 74, 187 Shuler, work of, in coal, 176 Shurkey well, strata in, 356 Sioux City Gas & Electric Light Co., plant of, 85; tests by, 88 Skidmore Brothers, mine of, 178 Smith, John E., work of, on fertilizers, Smith quarry, Lucas county, 219 Soil, characteristics of, 211; formation, 210; waste in Lucas county, 215 Soils, types of, 212; and soil conservation, in Crawford county, 344; in Lucas county, 210 Soldier rivers, character, 289 "Southern Iowa Loess" soils in Lucas county, 213 Spirifer pellaensis in Lucas county, 139 Spirit Leveling in Iowa, altitudes from, Springs in Crawford county, 357; in Lucas county, 206 Spry, W. R., analyses from, 80 Steam walls, radiant, 86 Stokers, types of, 83 Stone, production in 1925, 26; in 1926, 45 Story, D. Q., work of, in coal, 176 Stratigraphy of Crawford county, 292; of Lucas county, 123 Stream gradients in Lucas county, 114 ff; in western Iowa, 252

Stream valleys, difference in walls, 122, 284
Streams in Crawford county, 272; in Lucas county, 203
Streams, water from, in Crawford county, 357; in Lucas county, 203
Sulphur content of Iowa coal, 76, 92, 99
Swede Hollow, quarries in, 219; strata in, 155, 162

η'n

Table of precipitation in Crawford county, 358; in Lucas county, 204; temperatures in Lucas county, 205 Talcott well, strata in, 356 Temperatures in Lucas county, 205 Thompson, D. M., work of, in coal, 176 Tilton, J. L., cited, 81, 125, 131, 206, 211, 295, 317 Todd, J. E., cited, 279 Topographic map of Iowa, 376 Topographic maps, list of, 374; making, by U. S. Geol. Survey, 373 Topographic provinces in Crawford county, 255 Topography, agents forming, 264; of Crawford county, 247; of Lucas county, Troeltzsch, J. R., tests by, 80; cited, 81 Trost, F. W., acknowledgments, 221; work of, in coal, 180 Two Layer limestone in Lucas county, 144, 147 ff

σ

Unconformities in Lucas county, 134
Union Coal and Mining Co., mine of, 176
Union silt loam, 214
United Light & Power Co., plant of, 85
U. S. Bureau of Soils, cited, 212
U. S. Coast and Geodetic Survey, altitudes from, 366
U. S. Corps of Engineers, altitudes from, 366
U. S. Geological Survey, altitudes from, 366; bench marks of, 368; coal analyses by, 199; mapping by, 373
Upper coal beds, Lucas county, 183

٧

Vail, water supply of, 351
Valley walls, north and south, difference in, 284
Victor Fuel Co., Lucas county, 187

W

Wabash clay loam, 214
Wabash silt loam, 214
Wall lake, history of, 276
Wall Lake, gumbotil near, 305; sag valley near, 275
Walling, K. L., reports from, 350
Ward, brick plant of, 361

INDEX 557

Warrensburg sandstone, origin, 126
Warsaw strata in Lucas county, 140
Water from Coal Measures (Pennsylvanian strata), 203
Water supply of Crawford county, 346; of Lucas county, 203
Water walls, radiant, 86
Wells in Crawford county, 294, 346; typical, in Lucas county, 207
West Nishnabotna river, character, 289
West Side water supply, 350
West Virginia, analyses of coal from, 78
Wheeler coal in Lucas county, 147 ff
Wheeler's mill, Lucas county, 174
White, Charles A., cited, 106, 243, 244
White, S. W., work of, in coal, 126
White Breast coal in Lucas county, 144, 147
White Breast Fuel Co., work of, 173, 186

White Breast valley, age of, 119; coal in, 141 ff; strata in, 118; system, 116; terraces in, 117
Wild Cat creek, character, 119
Williams, I. A., cited, 126
Williamson, mine near, 179
Willow creeks, character, 291
Wisconsin gravels in Crawford county, 338
Woodbine, limestones at, 295
Woolston, Frank, samples from, 297

Y

Yarmouth and Kansan stages in Crawford county, 321

 \mathbf{z}

Zero, mine at, 186

