Subject Index

Advertising: with information about and to A&P stores, 226 Arbuckle Brothers, 116, 118-19, 121 sell inventions and patents, 22, 24-25; by Sears (1920s), 249 ARCO, 288 Agricultural Adjustment Act (1933): codes of Atlantic Works v. Brady (1883), 74n38 fair competition, 130; sugar refiners' pro-AT&T, 45n35 posed code under, 108, 131-32, 141 Automation, Ford manufacturing facilities, Alcoa, 314, 316-17 Allen C. Danzell et al. v. Dueber Watch Case Automobile industry: output of vehicles and Manufacturing Company (1893), 47 weapons during World War II, 185; post-American Artisan, 22 World War II growth and concentration, American Bell Telephone Company: assess-186. See also Ford Motor Company ment and purchase of inventions (1890s), Automobiles: automotive equipment in Sears 41-42; employee contracts related to instores, 232; insurance sold by Sears, 232, ventions, 44-45; in-house R&D established (1907), 42; patent department of, 41-42. See also AT&T Baldwin Locomotive Works, 68 American Column and Lumber Co. et al. v. Baltimore and Ohio Railroad, 65-66 United States (1921), 105-6 BAT, 265 American Institute of Chemical Engineers, Bearings, 23 315 Bethlehem Steel, 131 American Inventor, 22 Bicycling World, 23 American Iron Association, 309 Boeing: B-29 bomber production, 161; estab-American Sheet and Tin Plate Company, 46 lishment of Tooling Department, 157, American Sugar Refining Company (ASRC), 159; production experience prior to B-17, 110-11, 121, 122, 127, 132 160-61; production method for B-17 American Tobacco/American Brands, 265, bomber, 155-60; Seattle Plant No. 2-269, 275 Ford Willow Run plant comparison, American Woolen, 265 167-68; use and expansion of production Antitrust issues: effect of laws on performance areas, 155-60 of large firms, 264; information-exchange Boeing B-17 bombers: batch size and econoactivities of hardwood-lumber and mies of scale in production of, 155-61; linseed-oil industries, 105-6; litigation decrease in direct labor hours (1941-44),

151–55, 160, 162, 166–67; engineering

against Sugar Institute (1930s), 104-5

Boeing B-17 bombers (cont.) changes (1941–44), 162; initial model and variations, 149–50; production method, 155–60, 166–67

Boston Manufacturing company, 44n34
Brake cases. See Patents; Railroad patent associations; Stevens brake patent; Tanner brake patent

Braking systems: Stevens double-acting brake, 71, 76, 83–84, 98; Tanner double-acting brake, 97–101; Thompson-Bachelder double-acting brake, 97, 99–100

Browne and Sharpe, 300

Brunner Mond (Zeneca), 265, 272

Bureaucratic politics model, 209; applied to Ford Motor Company decision making, 211–16; players in game of, 210–11; weakness of, 217–18

Burmah/BP, 259, 288 Business historians, 15 Business History Conference, 5 Business History Society, 2

Cadillac Motor Car Company, 300 Carnahan Tin Plate and Sheet Company, 46 Cement Manufacturers' Protective Association et al. v. United States (1925), 106 Central Leather, 258

Charles H. Hapgood et al. v. Horace L. Hewitt (1886), 48n44

C&H (California and Hawaiian), 112, 116, 118–19, 122, 127–29

Chemical engineering, 313-17

Chemists: in industrial laboratories, 314; work with mechanical engineers in Germany, 317

Chicago, Burlington, and Quincy Railroad, 65–67, 86

Chicago and Northwestern Railway Company v. Thomas Sayles (1878), 71n30, 74n37, 97

Cleveland and Pittsburgh Railroad, 94 Cliometrics, 4

Codes, organizational, 199–200, 209, 217 Cognitive bias of managers, 210–11

Coldwell Banker, 238, 244, 249

Collusion: in acquisition of new technology, 11; incentives among Sugar Institute members for, 122–23; prices in collusive agreements, 108–9; Sugar Institute tools to support, 104–5, 139–40

Colonial Sugars Company, 121, 122, 124 Colorado School of Mines, 311 Colt, 300

Columbia University: School of Mincs, 310; Summer School of Practical Mining, 310 Commission on Recent Economic Changes, 2 Commission on Recent Social Trends, 2

Competition: under conditions of imperfect information, 8; effect on railroad industry, 76–81; in neoclassical economic theory, 6, 8; NIRA codes of fair competition, 130–32; in railroad industry, 67–68; in Sears's post–World War I market, 225; sugar refining industry (1920s), 110–13

Computer industry, 89-90

Contracts: of employers and employees related to inventions and patents, 21, 44–45, 48; mobility of patent holders and their, 32–40; restrictions for Sugar Institute members, 126–27

Copper mining: discoveries and production in Arizona and Montana, 311; discoveries and production in Michigan, 308–9, 311; production in Chile and United States (1845–1976), 307–8

Core capabilities/core rigidities, 199–201 Core competencies, 199, 209

Cotton spinning: ring and mule technologies, 301-3; Sawyer and Rabbeth spindles, 302 Cudahy Packing, 25, 26, 98

Data sources: for occupations of patent holders (1890–1910 and after), 36t; Profit Impact of Market Share database, 287

Dean Witter, 238, 244, 249

Department stores: pneumatic tube communication systems, 224; Sears urban retail, 226–27; uniform prices of and products sold by, 221–22

Division of labor: B-17 production (1941–44),

154, 166; in pin manufacture, 148
Doctrine of savings, 62–63, 69–76, 83–84
Domestic Sugar Bureau, 127–29
Douglas DC-3 airplane, 149
Dow chemical company, 314
Du Pont, 259, 272, 288; breakup (1911), 264; influence of, 316; in-house R&D, 44, 258

Eastern Railroad Association (ERA), 73–75
Eastman Kodak, 258
Economic History Association, 3, 5
Economics, neoclassical: based on perfect information, 6; theory of the firm in, 6, 8
Economic theory: based on scarce, imperfect, and costly information, 6; evolutionary, 7

Edison Electric/General Electric: R&D policy (1890s), 43

Edison Machine Works, 46-47, 51

Education: engineering curricula, 318-19;

mining engineering and metallurgy, 82, 310–11; risc of engineering, 82; standard-

ization for graduate degrees, 318; United States as leader in years of higher, 314

Electrical machinery, 300

Electric utility industry, 89

Electrolytic process, 314

Engineering Magazine, 51-52

Engineers: chemical, 313–17; contribution to railroad efficiency and productivity,

77-81; electrical, 89; mining, 310-13

Entrepreneurship: inventors as entrepreneurs, 21; role in industrialization, 4; Schumpeter's concept, 3

Experience curve. See Learning curve

Firms: court backing of invention ownership, 47–48; in evolutionary economics, 7; information problems of, 14–15; investment in new technology, 304; learning of, 7; learning related to inventors and patentees, 53–54; learning within, 15; in nco-classical economic theory, 6, 8; post—World War I reliance on technologies generated internally, 49; response to doctrine of savings, 62–63, 68–76, 83–84; rights to inventions and patents, 47–48; use of in-house R&D, 20–21

Firm size: ambiguity of, 289; association with scale economies, 288–89; industry distribution of, 289; large firms as engines of growth, 289–90

Ford Motor Company: Buffalo Stamping Plant, 192, 197, 212; Cleveland Engine Plant, 191-92, 197, 205-6, 212; decentralization principle in postwar period, 12-13, 189-98, 212-14; Edsel model, 207-8; at end of World War II, 186; engine manufacture decisions, 201-2; engine plants, 206; Facilities Committee (1949), 188-92; Fatcon, Galaxie, and Fairlane models, 208; Ford Division, 195-96, 212; Light Car division, 194-96; Lincoln-Mercury Division, 188, 194, 196, 208, 212; mass production, 167; restructuring in postwar period, 12-13; River Rouge Plant, 13, 193, 196-98, 212, 215-16; strategic direction decided in Executive Committee meeting (1949), 18693; Whiz Kids, 202–3; Willow Run–Boeing Seattle Plant no. 2 comparison, 167–68, 184

The Gap, 13, 241, 242, 243, 249

General Electric, 52

General Motors Corporation, 90, 188

Geological surveys, 305, 308-9

Gewerkschaft deutscher Kaiser (Thyssen), 269

Goodyear, 301

Grand Trunk Railroad, 94

Grangers: attempts to reform patent system, 92–93; constituent claims of patent infringement, 72

W. T. Grant, 226

Great Depression: effect on cane sugar refiners, 114–15

Growth theory, new or endogenous, 305–6 Guinness, 258

Harvard University, Center for Research in Entrepreneurial History, 3

History, economic and business, 2-5, 9

Hohenlohe Iron and Steel, 258

Howe truss, 64

Human action: in evolutionary economics, 7

IBM, 90

Information: about patents in journals, 22–23; cost of, 8–9; for economic success, 14–15; exchange among trade association members, 103; firms' efforts to gain and evaluate, 41–44; firms' use of in-house, 20–21; inequality of access in Sugar Institute, 12; in patented inventions, 22–24; railroads' pooling of, 11, 71–76, 93, 100–101

Information, technological: market for and trade in, 19–21, 24–31, 58–60; patent system in trade in, 21–25

Information exchange: among Sugar Institute members, 116–18; antitrust suits related to (1921–25), 105–6, 125; firms' violation of, 109; incentives for trade association members, 108–15; in railroad industry, 67–69; Sugar Institute and Domestic Sugar Bureau, 129; Sugar Institute's use of price rules and statistics, 104–5, 108, 113–23, 125–26, 133–34

Innovation: chemical engineering as, 313–17; network in interwar period, 319; in railroad industry in late nineteenth century, 78–79; role of railroads in, 80–81; scale Innovation (cont.)

in incentive structure for, 305–6; scientific, 320; Supreme Court model of, 63, 74, 84

Innovation, technical: engineered, 84; pipelines directing flows of, 81–87; in railroad industry, 83; in stage theory of technical change, 90; of Westinghouse, 64, 65, 85–86

Institutions: related to business history, 5; related to economic history, 2–5

International Harvester, 269

Inventions: arm's-length purchase of, 58–60; collective invention, 304–5; employee contracts related to, 44; firm contracts with employees to gain, 21; marketing of, 24; purchases by American Bell Telephone (1890s), 41–42

Inventions, patented: as property, 22, 59; railroad patent pools, 11, 71–76, 93, 100– 101; railroads bypassing market for, 62; trade in nineteenth century, 55

Inventors: assignment of patents (before, during, and after 1890–1910), 37–39; court rulings related to patent rights, 47; as entrepreneurs, 52–53; patent holders as independent, 37; property rights under patent law, 22. See also Patent holders; Property rights

Inventors Protective Agency, 75 Investment: of firms in new technology, 304; in firm-specific capital, 327–28; in knowl-

edge, 303–6

Jabez H. Gill v. United States (1896), 48n44

John Deere and Company, 269

Journal of the Society of Glass Technology, 23 J&P Coats, 265

Judicial system: antitrust cases against Sugar Institute, 104; application of doctrine of savings, 62–63, 69–76, 83–84; Stevens and Tanner brake patent cases, 71, 73–74; Sugar Institute case, 130, 132; trade association cases, 106. See also Antitrust issues

Just-in-time (JIT) production, 165, 181

William Knabe and Company, 44
Knowledge: acquisition of organizational, 328; cost of, 8–9; diffusion of, 306; investment in new, 303–6
Krupp, 269

Learning: about collusion, 139; American technological, 317; Boeing production of B-17 aircraft, 150–54, 160–70, 180–84; development of U.S. mineral potential, 308; within firms, 15; firms' use of employees' inventive talent, 49–54; information exchange in Sugar Institute, 118–30; labor productivity rise with, 183; by new experiences in B-17 production, 168–71, 175; railroads facilitating process of, 80; of sugar refiners, 133–34, 138

Learning-by-doing hypothesis, 147, 154, 162–63, 175

Learning by stretching, 168, 171–75, 180–82
Learning curve: for B-17 bomber program,
150–52, 166–67; B-17 data applied to
classical definition, 152–54, 168–70; departure from theory of the firm, 146–47;
discovery of empirical side of, 146, 148;
inability to predict labor hours reliably,
153; modification of, 168; relation to
economies of scale, 148–49

Lever Brothers (Unilever), 258, 269 Levi Strauss, 245 The Limited, 241, 242, 243, 249 A. P. Lorillard and Company, 45-46 Lowell Machine Shop, 43, 44n34

Macaroni industry, 131

McCahan Sugar Refining and Molasses Company, 107, 120, 122, 133-34

McCormack Harvester, 44

Machine-tools industry, 303

R. H. Macy and Company, 241

Mail-order business: based on uniform price concept, 221; of Montgomery Ward, 222. See also Sears, Roebuck and Company Mannesmann, 269

Maple Flooring Manufacturers' Association et al. v. United States (1925), 106

Markets: for inventions and patented technology, 24–31, 58–59; in neoclassical theory, 6

Matteawan Manufacturing Company, 303 Merchandising: in traditional department-store retailing, 241

Metallurgy: education related to, 82, 310–11; electrolytic process, 314

Metropolitan Carriage, 258, 269

Microsoft, 90, 327

Miller platform, 65

Mineral production, U.S.: copper mine produc-

tion (1845–1976), 308; increase in (1879–1928), 298–9; as proportion of world mineral reserves (1913), 307–8 Mining engineers: education, training, and experience of, 310–13; role in overseas development, 311. See also Columbia University; Copper mining Montgomery Ward, 222, 226, 227–29 Mowry v. Whitney (1871), 101

National Bureau of Economic Research, 2 National Industrial Recovery Act (NIRA; 1933), 130–32

National Rolling Mill Company, 46 National Sugar Refining Company, 121, 122, 126

Networks: characteristics underlying technological, 328; definition of, 296; of innovation, 319; net work externalities in technological progress, 296; of technological learning, 296; technology related to U.S. mineral potential, 14, 307–13; of trade, 300–301; U.S. national technological, 14, 295–96, 303

New York and Erie Railroad, 94 Nobel Dynamite Trust, 272

Official Gazette of the United States Patent Office, 23

Ohio Oil, 258-59

Organizational process model, 209

Organizations: actions of players, 209–10; cognitive biases of players in, 210–11

Patent applications, American Bell Telephone (1890s), 41

Patent assignments: distribution of (1890–1910 and after), 37–39; distribution of assigned patents (1870, 1891, 1911), 40; evolution (before, during, and after 1890–1910), 39–40; patentee/assignee relationship (1890–1910 and after), 35–39; patterns (1890–1910 and after), 35–37

Patentees. See Patent holders

Patent holders: compensation under "doctrine of savings," 62–63, 69–76, 83–84; contractual mobility, 32–40; court assessment damages for patent infringement, 69–76; inventors as, 38–39; occupational classes (1890–1910 and after), 36t; occupations and relationship to assignees, 35–40

Patent law: doctrine of savings in, 62-63, 69-

76, 83–84; evolution in United States, 92–93; proposed reform, 72–73, 76–77, 92–93. *See also* Patent rights; Property rights

Patent license: firms, 22; as medium of exchange among railroads, 68

Patent Right Gazette, 22

Patent rights: court rulings related to, 47; firms purchasing or licensing of, 22; firms' use, or shop, right, 47–48; inventors obtaining, 22; railroad association actions related to, 71–75; trade in patented technologies (1870, 1891, 1911), 40; transfer (1890–1910 and after), 38–39

Patents: computer industry, 90; cross-licensing in nineteenth century, 111; legal cases related to double-acting brakes, 71, 74, 76–77, 83–84, 97–101; for railroad devices (mid- to late 1800s), 93–97; railroad pooling of, 11, 71–76, 93, 100–101; railroads' lack of policy related to, 70

Patent system: distributive role, 81; as framework for trade in technology, 321–25; mechanism or structure provided by, 61; purposes of U.S., 22; railroads in conflict with, 64–69; role in innovation, 87–88; technical innovation flowing through, 82

J. C. Penney, 226

Pennsylvania Railroad, 65–66, 68–69, 79nn52, 53, 93, 94

Phelps Dodge, 265

Philadelphia and Reading Railroad, 66–67 Pin manufacture, 148

Power loom, 301

Prices: in collusive agreements, 108; openprice competition, 11–12; Sugar Institute's open-price rule, 108, 113, 140; transfer pricing systems, 205

Procter and Gamble, 258, 259, 269, 288 Progress function. *See* Learning curve

Prony dynamometer, 306-7

Property rights, 306; court backing of inventors', 47; enforcement of, 20; firms' employee contracts to gain, 21; inventors assigning patents to firms, 31–40; patent as, 59; provided by U.S. patent system, 22; trade in patented technology, 25–31. See also Patent rights

Property values, 305

Pullman Company: assessing value of new technologies, 48–49; employment contracts, 48 Railroad patent associations: asserting patents rights, 71–76, 100; assessment and evaluation role of, 80, 83; conditions giving rise to, 87; pooling of technical information, 11, 71–76, 93, 100–101

Railroads: attempts to reform patent system, 92-93; doctrine of savings as threat to, 62-63, 69-76, 83-84; influence on Court model of innovation, 63; internalized technical discovery, 62-63, 77-81, 88; patent license as medium of exchange among, 68; patents in nineteenth century, 64; productivity in late nineteenth century, 78; relations with suppliers of technology and parts, 67-68, 80; repair facilities (1850-80), 95-97; rise of engineers in, 78-79; standardization of track gauges in United States, 94; Stevens and Tanner brake patents, 71, 73-76; Westinghouse brake and signal technologies, 64, 65, 85-86

Rational-actor model: of Allison, 209; Ford executives, 217

Research: in economic history, 2; industrial research laboratories, 55, 297–98, 313, 318; in-house R&D laboratories, 20–21, 42–44, 258; organized corporate, 317–20

Research and development (R&D): current levels of outsourcing, 59–60; firms' internal, 11, 20–21; policy of American Bell Telephone related to, 42

Rio Tinto (RTZ), 258, 264, 265, 267 Rosie the Riveter, 163 Routines, 199, 209

Sassuolo, 274

Scale economies: association with firm size, 288–89; Boeing B-17 production, 155–60; models of scale-up economies, 171–75; of railroad suppliers, 80; supporting U.S. ninetecnth-century technologies, 306; in traditional department-store retailing, 241; of Wal-Mart stores, 239

Schechter Poultry Corporation v. United States (1935), 130

Schneider, 269

Scientific American, 22

Sears, Roebuck and Company: buys Coldwell Banker and Dean Witter, 238, 244; competition from similar merchandisers (1920s), 225–26; design of some products sold, 230; innovations (1920s), 232–33; innovations (1980s), 221; mailorder facility and business, 13, 223–24, 229–31, 327; merchandising skills, 221–25; response to decline in sales (1970s and 1980s), 233–38; saved by Rosenwald, 13, 223–25; urban retail stores, 13, 226–29; use of dated information technology, 240

Shell, 258, 265

Sherman Act (1890), 111

Shoe manufacture, 300-301

Siemens, 258

Singer/Bicoastal, 275

Social Science Research Council, 2

Solvay Process Company, 272

Sperry, 89

Spillovers, national technological, 296 Spreckels Sugar Company, 112t, 115, 122,

127, 129

Standardization: move for technical, 318; in railroad industry (1870s), 88, 94; of university graduate degrees, 318; in U.S. machine-tool industry, 303; of U.S. railroad track gauges, 94

Standard Oil of New Jersey (Exxon): antitrust action against (1911), 264; internal R&D (1928), 44; market power of, 258; R&D policy (early 1900s), 43–44

Steel industry, 131-32

Stevens brake patent case, 71, 76, 83–84, 98 Stover and Lang Speedometer Company,

43n31

Sub-Marine Signal Company, 52

Sugar Act (1934), 130

Sugar Institute: advertising activities, 142; by-laws, 115–16; Code of Ethics, 104–5, 108, 113, 126, 135–36; contract restriction, 126–27; Enforcement Committee, 107, 121, 123–24, 126, 140–41; exclusionary disclosure rule, 121–23; formation, rules, and structure of, 110–18; lack of mental model, 139–43; members' statistical reporting, 109–10, 114–23, 125–26, 133–34; reporting and information exchange system, 118–30; response to New Deal legislation, 130–33; Statistics Committee, 118–21

The Sugar Institute v. United States (1935), 111n12

Sugar refining firms: in American Sugar Refining Company, 10–11; formation of and adherence to mental model, 139–43; protection under Sugar Act (1934), 130; response to New Deal legislation, 130–31

Sugar Trust, 110, 139. See also American Sugar Refining Company (ASRC)

Tanner brake patent case, 71, 73–76, 83–84, 97–101

Technical change: in computer industry, 89–90; early railroad, 64–69, 77, 81–82; effect of railroad patent pools on, 101; emerging from networks, 295; network externalities in, 296; railroads internalize, 63, 77–81; stage theory of, 90

Technology: choices of cotton spinning, 301–3; collective inventions of nineteenth-century, 304–5; growth of nineteenth-century market for, 20; nineteenth-century U.S. interest in new, 304; patent system in market for, 21–25; railroad, 64–69, 78; railroad braking, 84–86

Technology, patented: market for (1870–1911), 25–31; trade in (1870, 1891, 1911), 40

Telegraph technology, 300

Telephony, 300

Texas Sugar Refining Corporation, 115 Textile-machinery manufacturing, 303

Thompson-Bachelder double-acting brake patent, 97

Thomson-Houston Electric Company, 51
Trade associations: defined, 103; enforcement of information-exchange agreements, 109–10; formation of Sugar Institute (1927), 111–13; information exchange among members of, 103; as interfirm collective action, 62; open-price, 105–6. See also Railroad patent associations

Trade protection: in Sugar Act (1934), 130 Transfer pricing systems, 205 Turbines, hydraulic, 306–7

Uncertainty: in evolutionary economics, 7–8 Union Switch and Signal Company, 85 United Cigar, 226 U.S. Congress: House Patent Committee hearings (1936), 49; interstate use of railroad air brakes and couplers, 94; patent legislation (1790–1861), 92–93; proposed patent law reforms (1870s), 62–63, 72–73; Senate Committee on Patents, 72–73

U.S. Geological Survey, 310

United States of America v. Dubilier Condenser Corporation (1933), 47n42, 48n44

U.S. Patent Office, 22-23, 53

U.S. Steel: Birmingham, Alabama plant, 307; collusive aspects of Gary dinners, 132; decline of, 258, 261; voting power under NIRA, 131–32

United States v. American Linseed Oil Co. et al (1923), 105n4

United States v. Sugar Institute (1934, 1936), 104n2, 130, 132–34

Utah Copper and Nevada Consolidated (Kennecott), 258

Vertical integration, 58–59 Vickers, 264

Wal-Mart: low-cost merchandising strategy, 13, 238–41, 249; supply strategies, 239–40; use of data capture and transmission technology, 240

Waltham Watch Company, 23–24, 43n31, 45 Western Railroad Association (WRA), 71–76, 85

Western Sugar Refinery, 116 Westinghouse: air brake, 64, 65, 85–86, 258; employee claims sole invention rights, 46; R&D policy (1890s), 43

Westinghouse air brake, 64, 65, 85–86 Whirlpool, Inc., 230

Whiz Kids, Ford Motor Company, 202–3

F. W. Woolworth, 226

Workforce, B-17 bomber, 163-64, 166

Work in progress: rising velocity in B-17 production, 164-65; subassembly areas for B-17 production, 155-57, 166