

Contents

<i>List of Illustrations</i>	ix
<i>List of Figures</i>	xi
<i>List of Tables</i>	xiii
<i>Preface</i>	xvii
<i>Acknowledgments</i>	xxi
PART ONE: ORIGINS OF A NEW INDUSTRY, 1865–1920	1
1. From Opportunities to Typewriters	3
2. Adding and Calculating Machines	25
3. Hollerith and the Development of Punched Card Tabulation	44
4. Cash Registers and the National Cash Register Company	64
5. Rudiments of an Industry Identified	79
PART TWO: AN AGE OF OFFICE MACHINES, 1920–1941	89
6. Economic Conditions and the Role of Standardization	91
7. Products, Practices, and Prices	105
8. Commercial and Scientific Applications of Punched Card Machines	128
9. International Trade in Punched Card Machines	137
10. The Great Depression in the United States	144
11. IBM and Powers/Remington Rand	149
12. Other Accounting Machines and Their Uses	158
13. Vendors, Practices, and Results	171
PART THREE: WORLD WAR II AND THE POSTWAR OFFICE APPLIANCE INDUSTRY, 1941–1956	187
14. Economics, Government Controls, and Applications	189
15. The Role of Major Vendors, 1939–1946	206

16. Industry Structure, Vendors, and Practices, 1945–1956	222
17. Business Volumes	247
18. Conclusion: The Roles of Marketing, Distribution, and Technology	264
<i>Notes</i>	289
<i>Index</i>	331

List of Illustrations

Following Part One, page 88

1. Christopher Latham Sholes (1819–1890)
2. William S. Burroughs (1855–1898)
3. John H. Patterson (1844–1922)
4. Herman Hollerith (1860–1929)
5. Early cash register
6. First adding machine, early 1880s
7. Hollerith Tabulator and Sorter Box, 1890
8. Burroughs Adding Machine advertisement, 1922
9. A section of the Tabulating Machine Room, U.S. Bureau of the Census, circa 1910
10. Tabulator and vertical sorter, 1915
11. Dorr E. Felt (1862–1930)
12. NCR branch office, Philadelphia, 1902
13. First Tabulating Machine School for Salesmen, C-T-R, 1916
14. The North Paulina Street factory, Chicago, 1913
15. Burroughs factory, Detroit, 1904–1911
16. NCR factory, Dayton, Ohio, in the interwar period
17. C-T-R management, 1919
18. Felt & Tarrant equipment at the Pennsylvania Railroad, 1910

Following Part Two, page 186

19. Cartoon from *Burroughs Journal*, 1926
20. Dalton adding-calculator machine advertisement, 1929
21. Remington Rand front-feed bookkeeping machine advertisement, 1930
22. A keypunch installation, circa 1920
23. Thomas J. Watson, 1914
24. IBM's first logo
25. An NCR cash register in China, circa late 1930s-early 1940s

26. Burroughs Desk Model Adding Machine, 1937
27. James Rand (1886–1968)
28. Keypunch assembly, IBM Endicott Plant, 1936
29. IBM Horizontal Sorter, 1938
30. Dr. Ben Wood and IBM punched card equipment
31. Thomas J. Watson, Sr. (1874–1956)
32. Edward A. Deeds and S. C. Allyn, early 1940s
33. NCR C-2000 Accounting Machine, 1930s
34. John Coleman, post-World War II
35. Card layout department at IBM plant, Endicott, N.Y., 1935
36. The first IBM graduating class of women systems service workers, 1935

Following Part Three, page 287

37. Remington Rand card punch, automatic printing tabulator, and sorter, 1941
38. IBM 100 Percent Club, 1940
39. The attitude toward computing in the 1930s and 1940s
40. Burroughs manufacturing facility, 1946
41. Adding machine manufacturing, Burroughs Detroit Plant, 1940s
42. IBM educational facility, Endicott, N.Y., 1948

List of Figures

1.1	An office of the 1890s	14
3.1	Capital investments in office equipment manufacturing in the United States, 1879–1948	62
3.2	Growth rates, 1879–1948	63
6.1	An IBM tabulator and summary punch (1935)	103
7.1	The IBM branch office in Washington, D.C., 1924	120
7.2	A punch card “data center,” circa 1920	121
12.1	A Burroughs Automatic Bookkeeping Machine, 1933	160
13.1	Historic Record of Burroughs Adding Machine Company Sales and Earnings, 1920–1941	175
18.1	First members of the IBM Quarter Century Club, 1925	279

List of Tables

1.1	Gross National Product for the United States, 1869–1921	8
1.2	Major Developments of the Typewriter, 1868–1896	16
1.3	Early U.S. Typewriter Firms, circa 1900–1917	22
2.1	Innovations in Adding and Calculating Machinery, 1820–1939	30
2.2	Adding and Calculating Machines Sold by American Arithmometer Company, 1895–1900	34
2.3	Total Machines Built and Sold, American Arithmometer Company, 1901–1904	34
2.4	Total Annual Sales, American Arithmometer Company and Burroughs Adding Machine Company, 1905–1916	35
2.5	Exhibitors and Products at the Napier Tercentenary Celebration, July 24–27, 1914	38
3.1	Innovations in Punched Card Machinery, 1917–1939	56
3.2	Growth in U.S. Office Work Force, 1900–1940	61
3.3	Growth in Type of U.S. Office Jobs, 1900–1940	61
4.1	Innovations in Cash Registers, 1879–1913	68
4.2	Number of NCR Cash Registers Sold, 1884–1922	71
4.3	Annual Volumes of Cash Registers Manufactured, National Cash Register and Their Sales Values, 1910–1913	72
4.4	Names of Some National Cash Register Company Subsidiaries, late 1890s	73
5.1	Sales Volumes for Office Furniture and Fixtures in the United States, Selected Years, 1901–1937	84
5.2	Net Earnings for Two Typewriter Firms, Selected Years, 1911–1917	85
5.3	Adder Machine Company Assets and Surpluses, 1910–1913	86
6.1	Value of Office and Store Machinery/Equipment, 1920–1929	95
6.2	Adding Machine Vendors in the United States, 1924–1925	99
6.3	Calculating Machine Vendors in the United States, 1924–1925	100
6.4	Bookkeeping Machine Vendors in the United States, 1924–1925	100

6.5	Billing Machine Vendors in the United States, 1924–1925	101
7.1	Products of Tabulating Machine Company, circa 1920	108
7.2	Products of International Business Machines Corporation, 1933	109
7.3	Punch Card Product Introductions in the 1930s	111
7.4	Prices for IBM Cards, Early 1920s, Early 1930s	126
9.1	IBM Products Marketed in Europe, 1930s	140
9.2	Major Users of Punched Card Equipment in Europe, Late 1930s	142
11.1	IBM Net Income, Net Profit, and Select Sales Revenues, 1919–1941	152
11.2	Comparative Statistics for Selected Business Machine Firms, 1928, 1939	153
11.3	Comparative Rankings within the Top Two Hundred U.S. Corporations by Size and by Value of Assets, 1930	153
12.1	Important Types of Information-handling Hardware, circa 1925	159
12.2	Age of Base Technologies of Adding Machines by Vendor and Type, 1885–1940	163
12.3	Functional Advantages and Disadvantages of Full- and Ten-key Adding Machines	165
12.4	Sample Commercial Applications for Calculators, 1920–1940	169
12.5	Calculating Machine Vendors in the United States, 1920–1930	169
13.1	Sales and Profits, Burroughs Adding Machine Company, 1942–1945	176
13.2	National Cash Register Company Sales and Profits, 1922– 1941	180
13.3	Shipments of Office Appliances in 1929	183
13.4	Value of Office and Store Machinery, 1920–1937	183
13.5	Pretax Income as a Percentage of Sales for Major Vendors, 1935–1939	184
13.6	Pretax Income as a Percentage of Sales for Major Typewriter Vendors, 1935–1939	184
13.7	Net Sales for Ten Major Office Equipment Suppliers, 1937– 1941	185
13.8	Sales as a Percentage of Total Industry Sales, 1934–1939	185
14.1	Office Machine Sales 1941 Compared to 1942–1944 Authorized Availability	195

14.2	Office Equipment Requirements, 1942–1944, 1941 Sales	196
14.3	Distribution of Machinery among Claimant Agencies, June 1, 1942, to December 31, 1943	197
14.4	Summary of Production, Shipments, Inventories, Unfilled Orders for 1944 and 1943	198
14.5	Maximum Permissible Production of Office Machines Compared to Actual Production, 1944	199
14.6	Combat-related Applications Using Office Equipment and Special Purpose Computers, 1939–1945	204
15.1	Revenues and Profits for Burroughs Corporation, 1939–1946	208
15.2	Sales for Burroughs and Major Competitors, 1939–1946	209
15.3	NCR's Sales, After-tax Profit, and Net Current Assets, 1939–1946	212
15.4	Revenues and Profits for IBM during World War II, 1939–1945	215
15.5	Net Sales for Remington Rand Corporation, 1939–1945	218
15.6	Number of Patents Issued, 1940–1946	219
15.7	Expired and Unexpired Patents by Company, circa 1950	220
16.1	Assets, Revenues, Employees of Ten Largest Office Equipment Firms, 1948	225
16.2	Sources of Revenues for Top Five Vendors, 1948	226
16.3	U.S. Distribution Outlets by Product Type, 1949/1950	228
16.4	Selected Statistics for IBM, 1946–1956	233
16.5	Net Sales for Remington Rand, 1946–1949	235
16.6	Net Sales for NCR, 1946–1950	237
16.7	Net Sales for Burroughs, 1946–1950	242
17.1	Annual Income for Machines Bull, 1949–1956	249
17.2	U.S. Imports of Adding and Calculating Machines, Cash Registers, and Parts, 1953–1959	251
17.3	U.S. Imports as a Percentage of Consumption, 1953–1958	251
17.4	U.S. Imports of Calculating Machines and Parts by Country of Origin, 1953–1959	252
17.5	Production of Adding Machines, Calculators, and Cash Registers in Italy, 1953–1958	252
17.6	Production and Foreign Trade. Adding and Calculating Machines and Cash Registers in Sweden, 1953–1958	253

17.7	Production and Foreign Trade, Adding and Calculating Machines and Cash Registers in West Germany, 1953–1958	253
17.8	Production and Foreign Trade, Adding and Calculating Machines and Cash Registers in the United Kingdom, 1953–1958	254
17.9	Number of Firms Manufacturing Adding and Calculating Machines and Cash Registers in Western Europe, 1958–1959	255
17.10	Office Machine Company Sales, 1947, 1949, 1951	256
17.11	Office Machine Company Sales as a Percentage of Total Industry Sales, 1947, 1949, 1951	256
17.12	Office Machine Sales, as a Percentage of Growth over Time, 1946–1951	257
17.13	Total Capital in the Office Equipment Industry, in Book Value and in 1929 Dollars, Selected Years, 1904–1948	257
17.14	Assets and Revenues of Office Machine Companies, 1949	258
17.15	U.S. Production and Sales of Adding and Calculating Machines and Cash Registers, 1953–1958	259
17.16	Office Equipment by Value of Shipments FOB and at Retail List Prices CIF, 1953, 1956, 1958	260
17.17	Total Cost of Computing: Hardware and Personnel Costs in the United States, 1953, 1956, 1958	262
17.18	Computing Costs as a Percentage of the U.S. GNP, 1953, 1956, 1958	262